MODERN DATA

DECEMBER 1970

TECHNOLOGY PROFILE

modems & multiplexers

Underpriced Overachiever: Varian's 520/i, the computer plus.

It's one economical computer that's more than a computer. It will, for instance, run dual programs because it has two complete sets of hardware registers, including index registers. And handle arithmetic functions in 8-, 16-, 24-, or 32-bit lengths within the same program, with precision changeable at any time.

Hardware? Two 32-bit accumulators, two 16-bit index registers, two program counters, two overflow registers, 11 interrupt lines. And a 1.5-μsec memory, expandable from 4K to 32K.

The price is $6,000. True, that isn't peanuts. But it isn't very much, either—especially when you consider the cost/performance ratio you get with the 520/i.

U.S. Sales Offices: Downey, San Diego, San Francisco, Calif.; Washington, D.C.; Atlanta, Ga.; Chicago, Ill.; Waltham, Mass.; Ann Arbor, Mich.; Minneapolis, Minn.; Albuquerque, N. Mex.; New Rochelle, Syracuse, N.Y.; Fort Washington, Pa.; Dallas, Houston, Tex. Other offices worldwide.

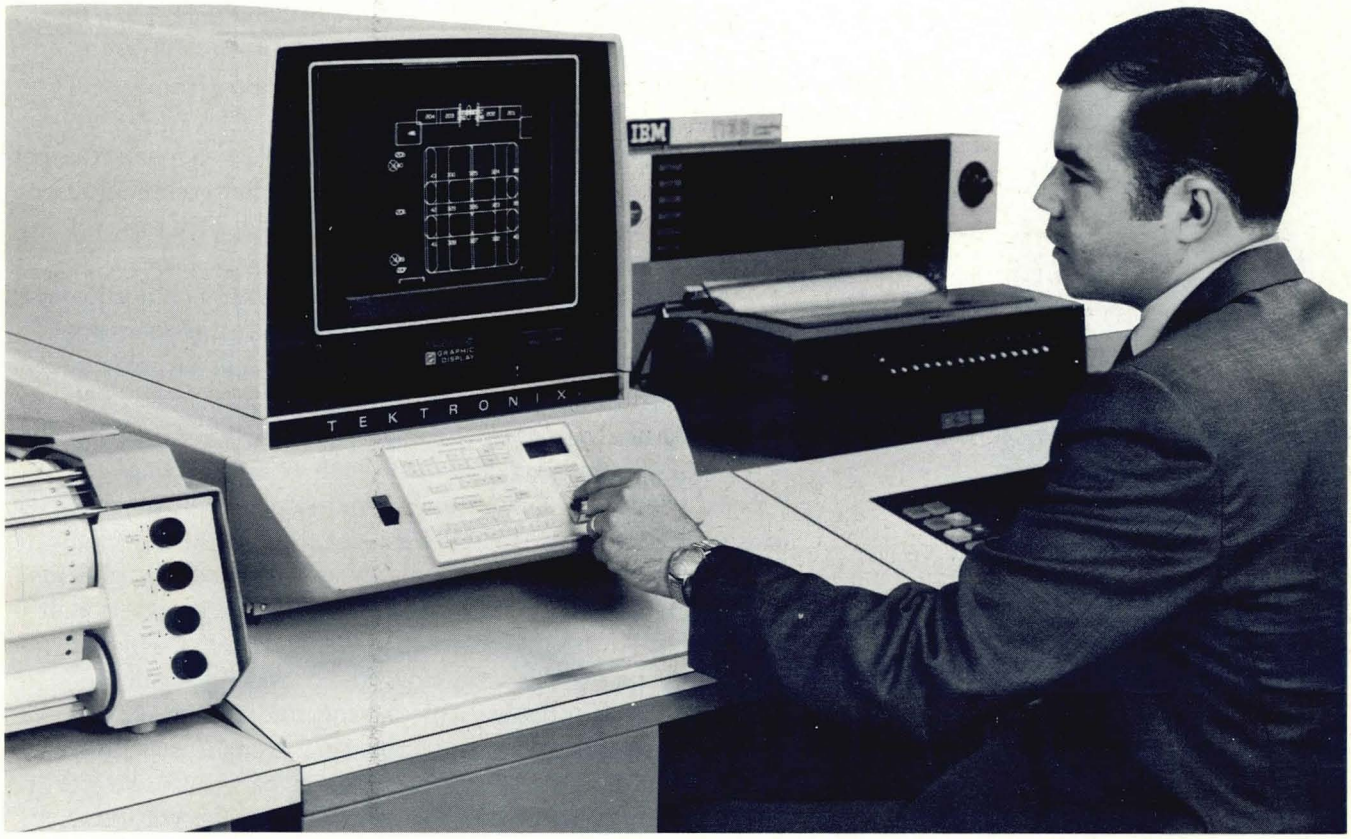
Varian Data Machines, a Varian subsidiary, 2722 Michelson Dr., Irvine, Calif. 92664. Telephone 714/833-2400.

varian data machines

The Big Company in Small Computers

CIRCLE NO. 1 ON INQUIRY CARD

New Graphic Display



saves programmer and computer time

The New Tektronix T4005 Graphic Display saves you time in many computer applications — especially where you use computers with mechanical plotters. The T4005 *displays drawings and text* on a Tektronix-developed 11-inch storage CRT at speeds up to 100 times faster than mechanical plotters. Use the T4005 speed to *quickly* verify results in preparing, modifying, and confirming programs. Then use your plotter to plot final results.

The T4005 is the most versatile peripheral of its kind. It performs many graphic functions such as display scaling, offsetting, framing, and augmenting—functions usually performed with software in other systems. With these and other T4005 features such as 32-times magnification, you obtain initial program results with less core storage and fewer program changes.

How can you get high quality copies *directly* from the CRT? Very quickly, very easily, and without tying up the computer. Just use the New Tektronix 4601 Hard Copy Unit. It produces a permanent, reproducible 8 1/2 x 11 inch copy in seconds!

For additional information, contact your Tektronix Field Engineer or Application Engineer; or write to Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

	U.S. Sales Prices FOB Beaverton, Oregon	U.S. Lease Prices Per Month
T4005	$7850	$305
IBM 1130 Interface	850	33
4601	3750	145

TEKTRONIX®
committed to technical excellence

CIRCLE NO. 2 ON INQUIRY CARD

Our new teleprinter runs so quiet we had to fake a little noise.

Operators couldn't get used to the eerie quiet of the keyboard on our new TermiNet 300* teleprinter.

So we added a little noise to give them some "feel." Even then it's quieter than an office typewriter.

And when it's running as a high-speed printer from tape or computer it's quieter still.

A front-panel switch lets you select a speed of 10 characters per second. That makes it compatible with the leading communications terminal. Or a speed of 15 characters per second. That makes it compatible with the leading computer terminal.

Or its unique speed of 30 CPS. Which makes it compatible with your special requirements of data handling, and saves you money.

But quietness and speed aren't all. We've built a whole raft of versatile features into the TermiNet 300 printer. That way it'll take care of your needs for years to come.

Things like horizontal or vertical tab. Long-print lines—up to 118 characters. Pin feed. A transparent mode. Remote 20-character answerback. Parity check. Full/half duplex operation. And many more.

Most of these options are supplied as simple modular plug-ins.

Which brings us to the reliability of modular construction. It's very reliable. And that's backed up by General Electric's nation-wide service. A point worth considering. And considering again.

Whatever your needs—time sharing, information systems, computer-outputed editing and formatting, even just repetitive printing—the TermiNet 300 teleprinter is what you should specify in your present system. Or in your next. General Electric Company, Communication and Control Devices Department, P.O. Box 4197, Lynchburg, Virginia 24502.

GENERAL ELECTRIC

TermiNet 300 DATA COMMUNICATION PRINTER

*Trademark General Electric Company, U.S.A.

CIRCLE NO. 3 ON INQUIRY CARD

MODERN DATA

DECEMBER 1970 ■ VOLUME 3 ■ NO. 12

58 TECHNOLOGY PROFILE
MODEMS & MULTIPLEXERS

The widespread use of telephone lines to transmit computer data and the ability to connect non-Bell equipment to such lines has effected a large increase in the number of modems and multiplexers available from independent manufacturers. This Profile describes the units, how they operate, and the factors to be considered when selecting a particular modem or multiplexer. Major characteristics of each model are listed in the tables.

80 AND IN THIS CORNER. . . . . RCA

In announcing their new family of computers, RCA predicts that they will have a billion dollar computer business by the late 1970's and will be number two. Guaranteeing a set conversion cost with a daily late penalty clause, RCA is attacking the very heart of IBM's empire. As one of our commentators states in this issue, it will take plenty of money, knowhow, hard work, and thousands of hungry salesmen.

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READER SERVICE CARDS ..... OPPOSITE PAGE 88

90 days

...delivery on all BASF disk drives and controllers

That's not a sentence . . . it's a promise. Today, when other disk drive manufacturers are quoting as long as 9 months, BASF will deliver in 90 days or less.

Promise — delivery in 60 days on the 114 Disk Drive, plug-to-plug and format compatible with IBM 2314.

Promise — delivery in 90 days (or less) on the 214 Disk Drive, the new lower-cost higher-performance alternative to the IBM 2314 disk drive.

Promise — delivery in 60 days on the 1014 Controller, that controls as many as 8 Model 114's or 4 Model 214's.

Send for the facts . . . then give us your verdict.

The new BASF 214

BASF

BASF SYSTEMS INC

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1313 West 8th St. Suite 129, Los Angeles, Cal. 213-483-8453

CIRCLE NO. 4 ON INQUIRY CARD

MODERN DATA

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Honeywell Time-Sharing systems are dedicated . . . problem solving . . . conversational . . . economical. The compatible H1640 series.

The H1642 is the lowest cost time-sharing system available with multi-language capabilities. BASIC, FORTRAN IV, SOLVE, EDIT, and TEACH. They work with the H1642 and all the others in the series,

Our H1644 and H1646 let you broaden capabilities in two easy steps. With additional field proven hardware and software . . . additional languages like COBOL and EXTENDED BASIC.

Make your big move with the H1648A. The fastest, most versatile system in the group. More employees will benefit from time-sharing. Yet they'll work with it in the same way as they do with our smaller systems.

Whichever system you choose, expect your employees to work with only 15 simple commands. Programs: over 200 scientific, utility and application packages. Simultaneous users: 16 to 64 with no slowdown in response time.

Move up when you want to. Ride ahead with confidence and economy. And a Honeywell Time-Sharing System. Write for our Time-Sharing brochure. Honeywell Information Systems, MS 261, 200 Smith Street, Waltham, Massachusetts 02154.

The Other Computer Company:

Honeywell

CIRCLE NO. 6 ON INQUIRY CARD

LETTERS TO EDITOR

To the Editor:

Your column in the April, 1970 issue of MODERN DATA was entitled "Data Base Systems" and discussed the CODASYL Data Base Task Group report on data languages. You stated that "At least two manufacturers are now building systems to simulate the structure suggested in the CODASYL report."

I would appreciate it if you would identify for me those manufacturers who are implementing or have implemented the CODASYL report.

Byron W. Krause,
A C Electronics,
Div. of Gen. Motors,
Milwaukee, Wisc.

The Author's Reply: *Thank you for your Sept. 18 response to my April Data Base article. If I could catch up to the point of being only 6 months behind in my reading, it would be a great improvement.*

In answer to your question on implementation of the CODASYL data base structure, the two manufacturers were GE and Univac. GE had announced its IDS system, but I don't know what has happened in the shuffle. Univac made its official announcement at an ACM symposium in N. J. To the best of my knowledge Univac is following up.

Thomas DeMarco,
Mandate Systems, Inc.,
New York, N.Y.

■ ■ ■ ■ ■ ■

To The Editor:

I note that in your Sept. 1970 Source Data Automation column you use 6500 keystrokes per hour as a constant. May I inquire as to your source for this quantity? I have been under the impression that 8000 strokes per hour was the national average. This figure was used when the company I was with at the time first set up key punch operations in Tijuana, Mexico.

M. C. Langdon,
Project Manager,
Dept. of Water Resources,
Sacramento, Cal.

The Author's Reply: *As the old response goes "I'm glad someone asked that question." Seriously though, I received the same question when I went over this example at our Source Data Automation Seminar a few weeks ago in New York City. My response was to ask several members of the audience what keypunch stroke rates were obtainable at their installations. The answers varied all over the lot (e.g., 5000-12000 strokes per hour). Our discussion revealed that stroke rates depended on such factors as the quality of their operators, the type of data they were inputing, operator motivation, physical environment, etc.*

The exact words utilized in our September SDA column were as follows: ". . . 6500 strokes per hour is the average rate of **my** *keypunch operators on* **my** *type of input data." I have underlined the word "my" where it appears to emphasize a point. That is, use live operational data where possible in any keyboard entry cost calculations. What good is it to use a national standard for keypunch rate when your operators produce at a different rate? The figure of "6500 sph" was obtained from a client of ours for whom we were performing a study of data entry devices and their relative costs. He was concerned with obtaining as accurate (not average) cost figures as possible. I can only reiterate that the figures used in our column were determined by actual experience and were not intended to be those of the average installation (if there is such a beast).*

Bennett A. Landsman,
Information Spectrum, Inc.,
Cherry Hill, N.J.

Custom keyboards. "Stock" cost.

This unique ferrite core switch makes it possible. Keyboard assemblies are automatically machine wired at our factory.

Determine your code. Design your own keyboard format. Standard or special, the unique Licon® Series 550 keyboard design will accommodate it. At standard prices. And if you should revise your code, Licon can do it at low cost, with little effort. All because this simple, reliable design is different from every other keyboard made. It's based on the most dependable, least expensive switching element ever developed. As reliable as a magnetic core, because that's what it is. All solid state, but simple! Encoding is right at the switch. No diode encoding matrix, no MOS chips, no mechanical linkages. 25 million test cycle dependability. Strong three-volt peak-to-peak signal at the switch. "Bounce" free switching. Options include shift, shift lock, parity encoding, internal strobing, multi-key interlock, lockout and rollover. And the interface with your equipment is a simple plug-in connector. Ask for a live demonstration. We'll plug one into your equipment. To see (and to operate) is to believe. Licon, 6615 W. Irving Park Rd., Chicago, Ill. 60634. Phone (312) 282-4040. **Send for brochure or a "plug-in" demonstration.**

itw LICON

CIRCLE NO. 8 ON INQUIRY CARD

the real $39 a month CRT terminal from the real real-time people

Somebody promised you a $39 computer terminal. Bunker-Ramo delivers — the 2210.

It breaks the $$$ barrier for on-line terminals at bank teller stations, factory assembly points, hospital wards, credit departments, utilities, warehouses and countless other locations.

The 2210 has all the necessary features: tab, fixed format, skip, computer-call, variable lay-out, conversational mode, plus a special block keyboard for easy operation by non-typists. Interfaces with present data processing systems without costly modifications.

Price includes maintenance by Bunker-Ramo's nationwide field service staff.

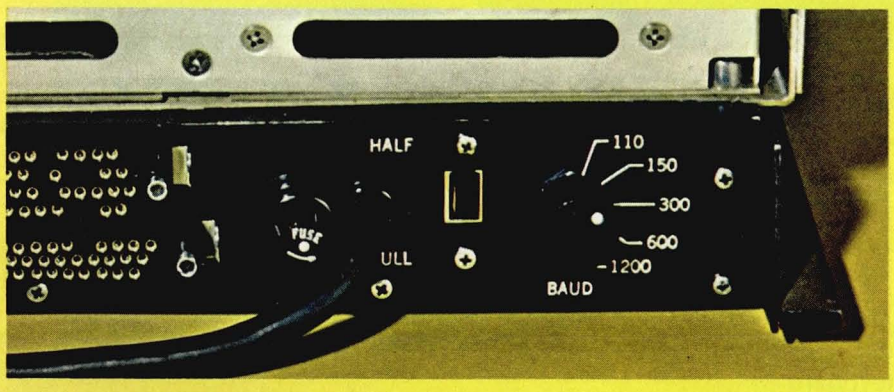
Before you install any — or buy more — CRT's, contact us for complete information on the economical, easy-to-use 2210.

The real real-time people

THE BUNKER-RAMO CORPORATION
Business & Industry Division
445 Fairfield Avenue, Stamford, Connecticut 06904. Phone: (203) 348-4291

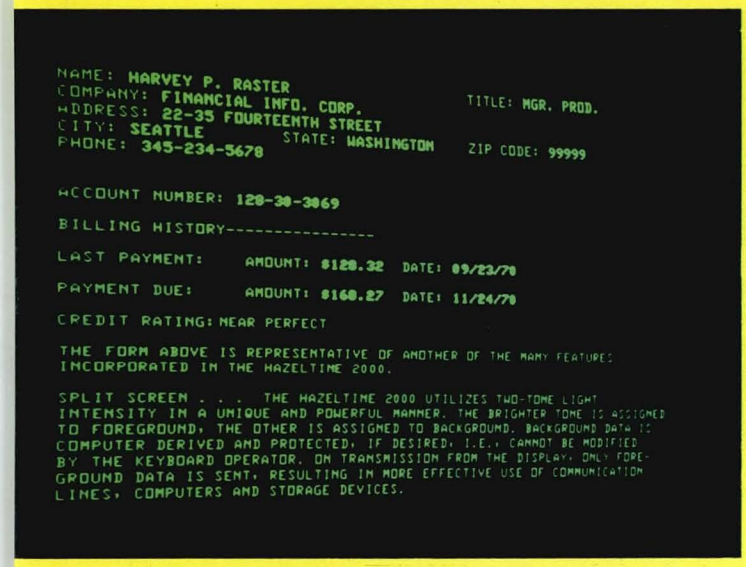
1,998 character display (27 lines of 74 characters each) on a 12-inch screen.
A true stand-alone unit—includes communications interface and modular power supply,

Inside Story of the Video Display Terminal that leaves all the others behind.

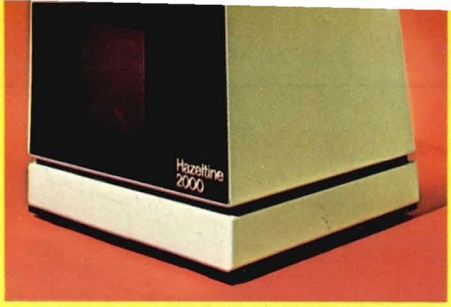


Switch-selectable full- or half-duplex operating modes.
Selectable transmission rates—110, 150, 300, 600 or 1200 baud. Adjustable up to 9600 bps.

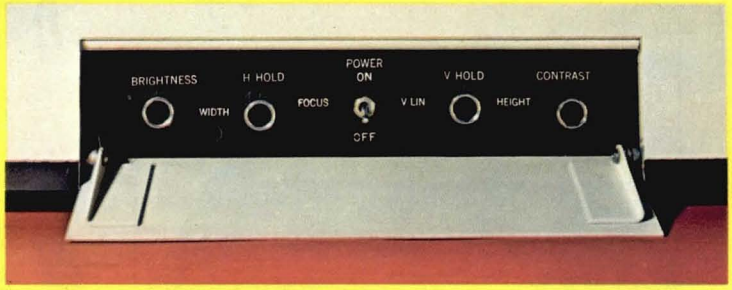
Powerful editing capability—12 distinct keyboard operations, including line and character insert/delete. 10 functions under computer control, including cursor positioning by X-Y coordinates.



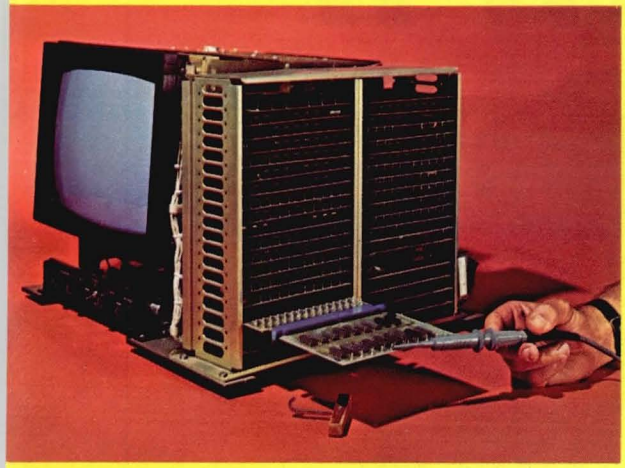
Two-level video intensity. Useful for form fillout. Computer-derived protected data is lower intensity; operator-entered data is brighter.
Selective scrolling at any line when under program control; automatically at line 1, unless otherwise directed.
Automatic tabulation in form fillout directs cursor to next entry point.



3 remote monitors may be connected without amplifiers. With amplifiers added, the number is unlimited.

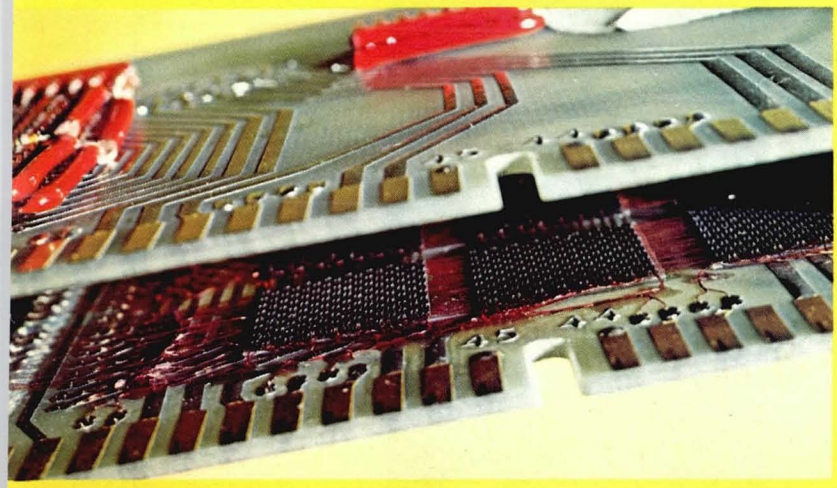


Individual TV adjustments conveniently located up front for optimum operator comfort.



Reliable solid-state circuitry assures virtual trouble-free operation. Maintenance is as easy as opening a drawer.

Quiet, solid-state keyboard in Teletype terminal format may be operated remotely.



High-speed, random-access core memory (2048 x 8) provides flexibility and efficiency consistent with all the unique design features of the Hazeltine 2000.

Plus: Low Cost!

$88 per month (12-month rental) plus $20 maintenance.

We'll be happy to demonstrate the Hazeltine 2000 in your offices.

Hazeltine 2000

Hazeltine Corporation

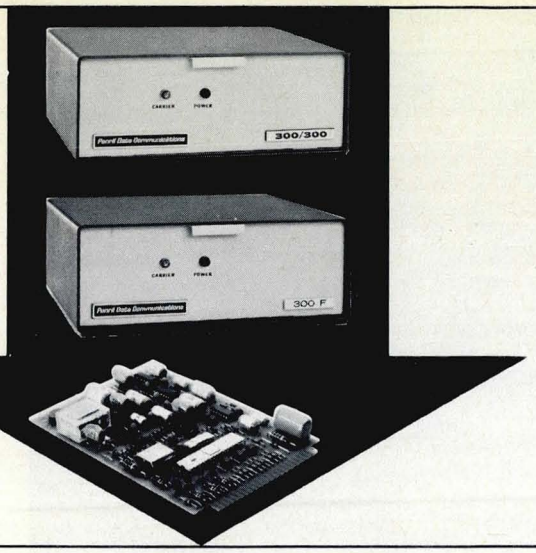
Little Neck, N.Y. 11362 Phone (212) 423-4800

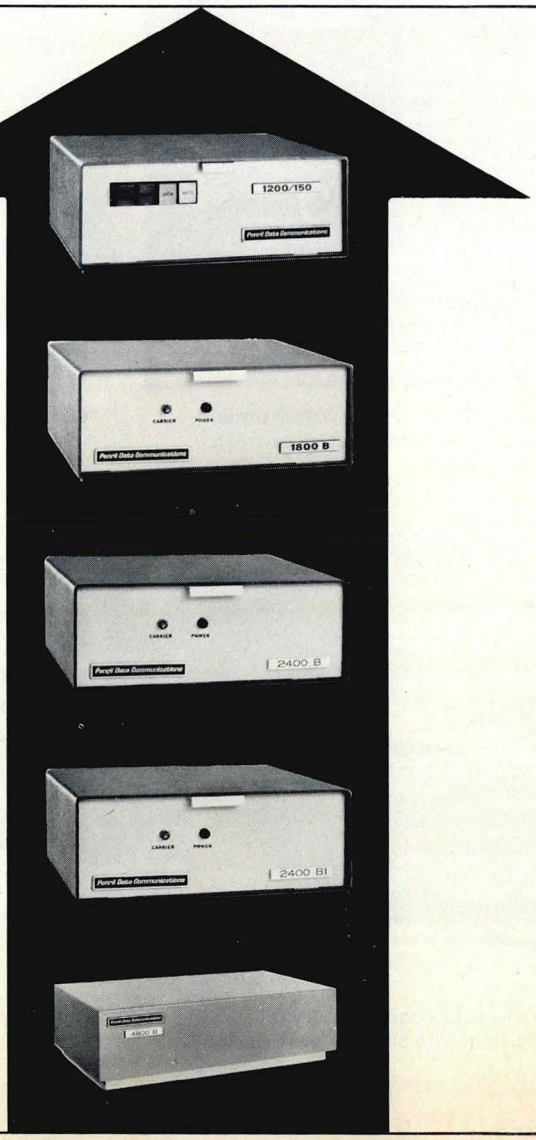
CIRCLE NO. 10 ON INQUIRY CARD

MODEMS

by

Penril





Our modems *are* better; our prices *are* lower.

Our 4800 bps modem has a fully automatic equalizer, but it sells for only $3500. We are prepared to demonstrate its performance on your lines, in competition with any other modem, even the most expensive.

At 2400 bps we offer two modems - one for dial applications; one for dedicated lines.

Our 202C equivalent incorporates MOS/LSI design. The complete modem, including control functions, is on one 4" x 7" pc card. The reverse channel will go to 150 bps. There is nothing else quite like it.

We have a complete family of 103 equivalent modems and a 101C equivalent that's in a class by itself.

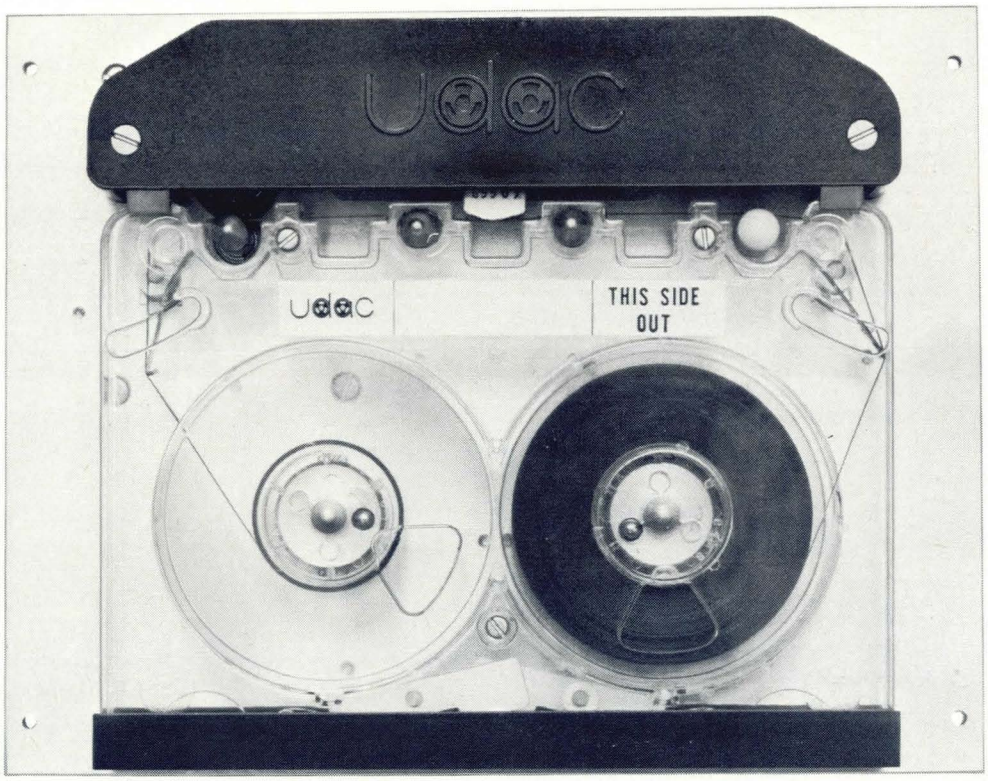
Need a modem . . . a *better* modem?

Give us a call . . . that's our business.

PDC Penril Data Communications, Inc.

960 THOMPSON AVE. ROCKVILLE, MARYLAND 20852 301/881-8151

Computer Expander



UDAC's Model 160 Tape Deck

Imagine a compact unit so versatile and flexible it can "double in brass" as a: Buffer Storage Device, a Data Collection Device for Audit Trail purposes, a Memory Augmentation Unit for Terminal and Mini-Computers and as a Replacement for Paper Tape Punches and High-Speed Readers. That's UDAC's new Model 160 Tape Deck. It gives data faster . . . more reliably . . . and at lower cost, too!

USES CARTRIDGES —

Up to 1,440,000 characters at 400 bpi are stored in UDAC's "snap-in/pop-out", 5″ x 7″ cartridges. There's no threading, no reel locking, and any format consistent with bit density can be used: RZ, NRZ, NRZI or RB. Accepted data returns by a record status line to external equipment.

OPERATES IN FOUR MODES —

I. Record and playback on command by character.
II. Record on command by character and playback slew rate with no blocking.
III. Record and playback slew (block command).
IV. Record and playback, 8-level code by character.

REPLACES P/T PUNCH AND HI-SPEED READER —

Two available options, a Read Pre-amp/Write-Erase Driver Card and a Data Dispatch Card can be interfaced, permitting the basic deck to function as a Paper Tape Punch and High-Speed P/T Reading unit.

GIVES OEM'S A COMPETITIVE EDGE —

If you are a Computer OEM, the Model 160 Tape Deck can add both utility and versatility to your line regardless of size. Result: more sales to more markets in less time.

For complete technical and application data, contact:
Marketing Manager,

udac

Universal Data Acquisition Company
An MCA Tech. Division
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Los Angeles, California 90064
(213) 478-0261

CIRCLE NO. 12 ON INQUIRY CARD

If you need 500 ns get us this coupon the fastest

You'll get the facts on our new 500ns memories and stacks. Memories and stacks that you can get two months faster than anybody else's.

Ours will likely beat anybody else's price per bit, too. On any size order.

Here's the new line: The CC-50 stack and the CC-50 memory. The CEX-50 stack and the CEX-50 memory.

Between them they'll meet about any need you have for 500ns cycle times.

If it's a million bits or less you need, you're best off with our CC-50. It's 3-wire, 3D. With 4K, 8K or 16K words.

Over a million bits puts you in our CEX-50 class. It comes in 3-wire, 2½D organization. Words: 16K, 32K or 64K.

And, stack or system—CC-50 or CEX-

memories or stacks fast, way you can.

50—you'll get the only modular 500ns design anywhere.

There's something else unique about this new line. Something brand new. We don't have space enough to explain it here, but our spec sheets will give it all to you in glorious detail.

Quick, the coupon.

LOCKHEED ELECTRONICS Data Products Division/Los Angeles (213) 722-6810

M.D. 12/70

☐ I'm drooling.
Get me CC-50 and CEX-50 data immediately.

☐ Take your time.
I only need CC-50 and CEX-50 data for my archives.

Name_____

Position_____

Company_____

Street_____

City_____ State_____ Zip_____

Lockheed Electronics Company

Data Products Division 6201 East Randolph Street, Los Angeles, California 90022

CIRCLE NO. 13 ON INQUIRY CARD

If your office needs to take or send information up to 1200 words per minute, we have a way.

Our Dataspeed® Magnetic Tape Terminal.

It bridges the gap between low-speed keyboard preparation and high-speed on-line data transmission.

At the same time it reduces the cost of data transmission over regular telephone lines.

The data that is sent and received is recorded on a compact cartridge that has a capacity for 150,000 characters. And the tape is reusable once the information on it is no longer needed.

Besides communicating at high speeds, the terminal has a Forward/Reverse mechanism that can search for specific data on the tape at a rate of 4,000 characters per second.

And time-consuming correction procedures are cut to a minimum since individual lines or characters can be easily located and corrected within a message.

The terminal can be adjusted to answer calls automatically, too. Transmission can be sent and received over regular telephone lines (Data-Phone® service) or private line service.

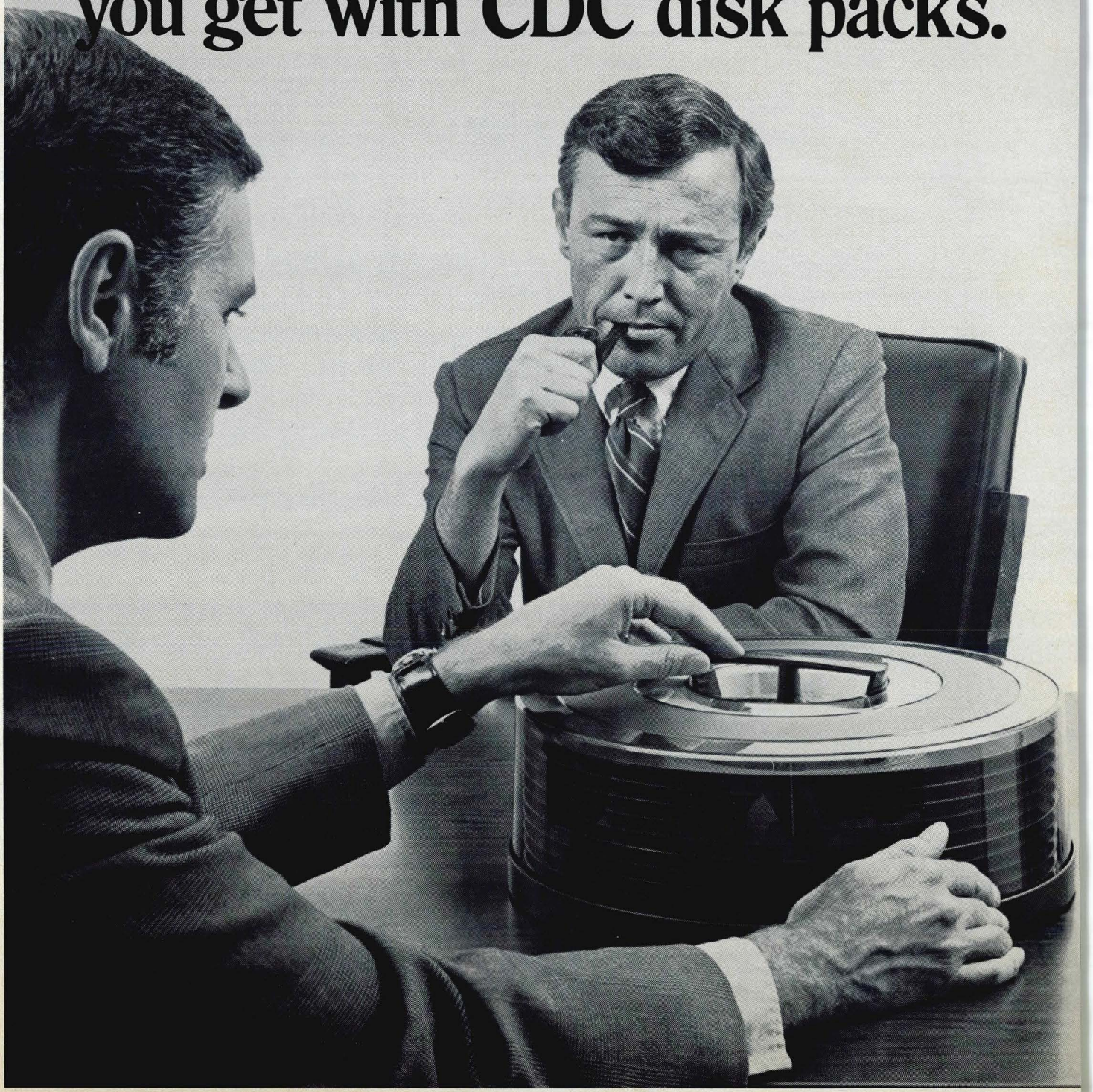
Often at low-cost after-hour rates.

Call your local Bell Company Communications Consultant for information on how our Magnetic Tape Terminal can be implemented within your existing system without major redesign.

The American Telephone and Telegraph Company and your local Bell Company keep working to improve telephone communications.

This time by helping you communicate at speeds up to 1200 words per minute.

First, Bill Dean tells about the quality, performance, back-up you get with CDC disk packs.



Then he tells you the cost.

You'll say, "Wait a minute. If a CDC disk pack is so much better, how come it's priced the same or even lower than other packs?" And that will give Bill (or any other CDC representative) an opportunity to tell you about our new disk pack manufacturing center in Omaha.

We started there with the concept of building the highest performance, most reliable, longest lasting disk pack available anywhere. And we did. We also worked out techniques and systems to make our packs at a competitive price. And that was tough.

CDC inspects each pack at every stage of manufacturing and four times when it's assembled and ready for shipping. We do the quality control so the customer won't have to.

Add to all that special care the professional after-sale service and back-up we provide. It *does* begin to seem a little strange about that pricing.

But that's our problem. Yours is how to get in touch and get our free booklet on what we're talking about.

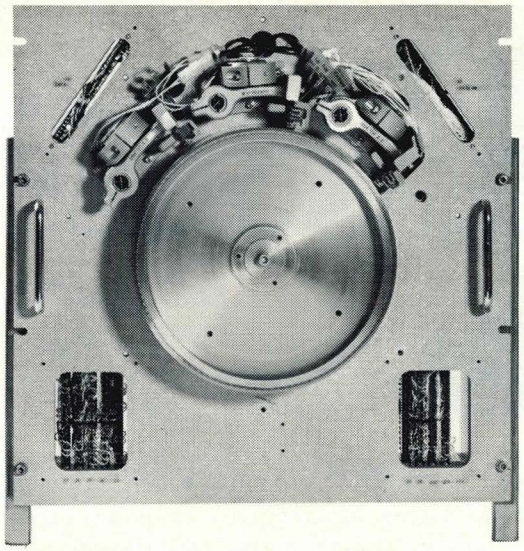
Call your nearest CDC sales office, circle the number below, or phone directly to our main office on our "hot line." Call, collect, (612) 884-8195.

CONTROL DATA CORPORATION

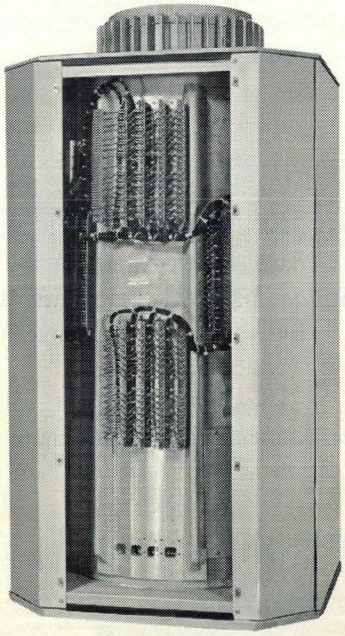
Business Products Group
Dept. 333
Control Data Corporation
P.O. Box 1980
Minneapolis, Minn. 55111

1970: A Bryant and remember an

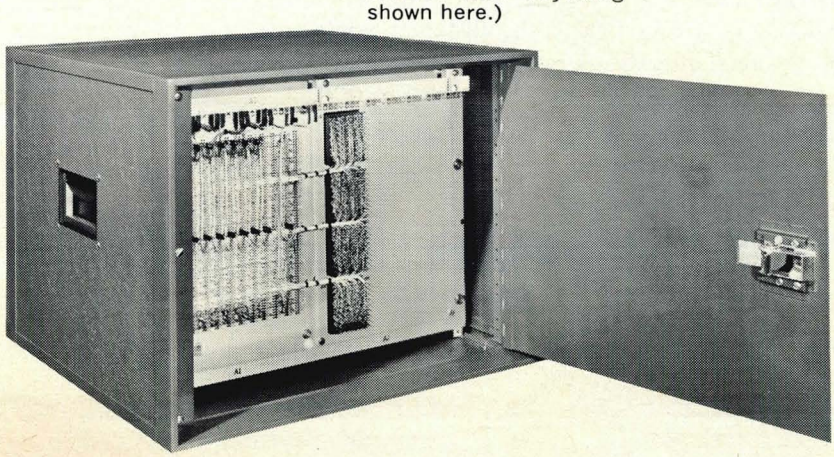
The CLC-1 Drum. A genius that never forgets.



The AB Drum Series. For plug-in growth potential. This is the 18″ model. We also have a 10″ one. They're both great.



The 720 Mini-Controller. The Napoleon of the computer industry. (Can interface with anything shown here.)



year to remember
d remember and rei

We want to be thought of and remembered as the largest independent manufacturer of magnetic memory drums, disc files and complete memory systems in the world.

Well, you don't get there by sitting on your hands.

You do it by using your head. Thinking ahead. And you introduce new products.

So we did all that. All in 1970.

A new drum. Our CLC-1. With 50% more storage. In the same space as the old one.

A new disc storage drive. Our 1100. That ought to go for $25,000. But sells for a lot less.

A new mini-controller. That thinks big. Our 720. Big enough to handle as many as eight of anything shown here. And instantly compatible with your mini-computer.

A new CD Drum. That remembers twice as much as it used to.

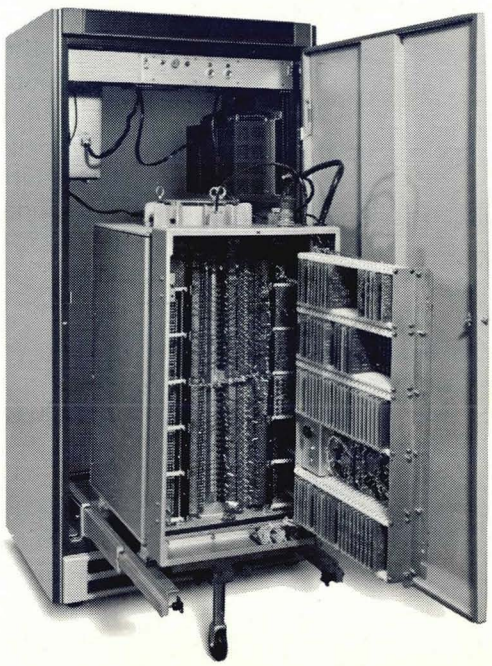
A new AB Drum series. In 10″ and 18″ models. With plug-in growth potential.

1970. A year to remember, indeed.

In fact, the only thing that could make you forget 1970—is what we're doing for 1971.

BRYANT
COMPUTER PRODUCTS

The 1100 Disc Storage Drive. You get everything the IBM 2311 has. Except that you get it for a lot less.



The CD Drum Series. Shown here, the 10″ model. It remembers twice as much as it used to. You should see its big brother.

A UNIT OF

XLO®

EX-CELL-O CORPORATION

CIRCLE NO. 15 ON INQUIRY CARD

NEWS ROUNDUP

TWA, BURROUGHS BATTLE

Trans World Airlines announced that it has "discontinued all efforts to use a Burroughs Corp. computer (for its automated passenger) reservation system and that it has instituted suit against Burroughs . . . to recover damages in an amount exceeding $70 million for misrepresentation and breach of contract." The cancellation applied to a B 8300 system valued at approximately $38 million. According to Burroughs, which has filed a countersuit denying TWA's charges and asking for $11.5 million in balance owed and interest, the basic system was designed to TWA's specifications and sold with the understanding that the airline would develop its own applicational software. Burroughs said it first learned the suit had been filed at the onset of a N.Y. meeting with TWA representatives after being advised by the airline that it expected Burroughs to compensate them for losses resulting from delays in the full operational use of the system. TWA has already announced its intention to implement an advanced version of IBM's PARS (Passenger Airlines Reservation System) on S/360 Model 65 or 75 computers. Versions of PARS are presently in use by Eastern and United Airlines.

JUSTICE DEPT. SUPPORTS NEW CARRIERS

The Justice Dept. has advised the FCC that it favors the licensing of new common carriers to compete against AT&T and Western Union in the microwave transmission area. The Justice Dept. supported the new applicants' contentions that the established carriers have not adequately responded to modern needs for specialized data communications and that present telephone services were neither priced nor designed to meet these needs.

NO LOVE LOST

American Telephone and Telegraph Co. asked Federal Communications Commissioner Nicholas Johnson to disqualify himself from participating in FCC matters involving Bell System companies. In a "petition for disqualification" addressed to the Commissioner, AT&T characterized remarks Johnson made in a speech to the Digitronics Users Assoc. Conference on Oct. 19 in Chicago as demonstrating "a deep-seated bias and prejudice against the Bell System." Johnson's speech was entitled *"Why I Am A Conservative Or For Whom Does Bell Toil?"*

TWO NEW IBM COMPUTERS

IBM simultaneously announced two new computers: a lower-priced version (Model 6) of its System 3 computer; and a modular "sensor-based" processor (System 7) for industrial applications. The S/3, Model 6 is designed for problem-solving as well as commercial applications and is available with up to 9.8 megabytes of disk storage; a BASIC compiler; and a Model 2265 display. The 1.5 usec., 8 to 16K machine is primarily a stand-alone "office computer," however, and is offered with a simplified keyboard/control panel and a choice of five printers, including two with 22″-wide carriages for ledger cards. Like the previously-announced Model 10, the Model 6 is programmed in RPG II and uses the 96-column punched card. Model 6 configurations will be priced from $1,015/mo. (typical: about $1,600/mo.) and made available in March, 1971.

The all-monolithic System 7 is basically a data acquisition and control system which can be environmentally isolated for unattended operation in difficult industrial and laboratory conditions. Capable of being used either independently or in conjunction with a larger, host computer, the S/7 is so modular in design that it carries a base price of $352/mo. — making it unquestionably IBM's lowest-priced computer.

1975 MINI MARKET

Creative Strategies, Inc. of Los Altos, Cal. predicts nearly a 50% annual growth in sales of minicomputers and associated peripherals over the next five years — reaching an annual level of $1.5 billion in 1975. The consulting firm pointed out in a recent report that business EDP would eventually constitute the largest market sector, experiencing sales of $471 million during 1975. The report also predicted that both CPU prices and the number of minicomputer manufacturers would be reduced by more than 50%.

3 NEW ELECTRONIC MARKETING HANDBOOKS

A HANDBOOK ON MARKET RESEARCH

This book was prepared specifically for the marketing man who has had little or no formal training in market research and statistics. It is meant to guide the manager who must do his own market research or else do without. It is meant for the man for whom market research is just one of several marketing responsibilities. It is meant for managements who want usable information at reasonable cost and minimal delay. It is meant for the manager who will be buying outside services and wants to get behind the specialist's jargon to a basic understanding of the art.

In fourteen chapters the manual covers . . . INTRODUCTION . . . THE HUMAN NATURE OF MARKET RESEARCH . . . THE USE OF SECONDARY DATA . . . THE USE OF INTERNAL DATA . . . SURVEYS, BASIC CONSIDERATIONS . . . SURVEYS, QUESTIONNAIRE DESIGN . . . COMPANY IMAGE STUDY . . . EVALUATING COMPETITION . . . SALES FORECASTING . . . TECHNOLOGICAL FORECASTING . . . QUOTAS . . . PRODUCT PLANNING . . . EVALUATING SALESMEN . . . RECOMMENDED READING

The Handbook On Market Research For The Electronics Industry contains over 156 pages (8½" x 11", two column, soft covers). It is priced at $37.50. Readers say material of this kind is worth more!

A HANDBOOK FOR PRINCIPALS ON MANUFACTURERS' REPRESENTATIVES

Other books have been written about reps. But those were for the guidance of reps or propaganda in their cause. This book fills a different need. It provides information and how-to advice for *principals*. No sponsoring association has censored out material beneficial to principals at the cost of disadvantages to reps.

In thirteen chapters, the book covers . . . SELLING TO THE ELECTRONICS INDUSTRY . . . SALES CHANNELS . . . COMPANY SALES FORCE OR MFRS' REPS . . . RECRUITING REPS . . . MARKET POTENTIAL, TERRITORIES AND QUOTAS . . . COMMISSIONS . . . THE CONTRACT . . . SALES TRAINING . . . FEEDBACK FROM REPS . . . REPS AND INQUIRES . . . GOING DIRECT . . . THE REP'S IMAGE . . . THE FUTURE OF THE REP.

Written entirely for the guidance of the principal and advising in his interests, *The Handbook For Principals On Manufacturers' Representatives* contains 85 pages (8½" x 11", two column, soft covers). Now in the second printing, it is priced at $15.00.

AN ADVERTISING/PROMOTION HANDBOOK

This is not a book on how to write copy and purchase graphics. It is a selective guide on how to get value for your advertising/promotion investments. Though most ad managers, ad agencies and trade publications will find this book quite instructive, it was written for the *marketing manager* who personally handles advertising/promotion as one of several marketing functions . . . for marketing managers, as well as *top managements*, who never handle advertising personally, but want practical criteria by which they can evaluate the claims, recommendations and performance of their ad managers, agencies and publications.

In nine chapters this book covers . . . INTRODUCTION . . . MEDIA SELECTION . . . INQUIRIES . . . MEASURING ADVERTISING EFFECTIVENESS . . . DIRECT MAIL . . . PUBLICITY . . . AD AGENCIES . . . TRADE SHOWS . . . ODDS AND ENDS.

An Advertising/Promotion Handbook For The Electronics Industry is not a rehash of academic texts and dubious publication research. *ALL* of the material is original. The manual contains over 165 pages (8½" x 11", two column, soft covers). It is priced at $30.00.

MAINLY MARKETING, DEPT. MD, P.O. BOX 35, LARCHMONT, N.Y. 10538

☐ Enclosed is my remittance of $37.50. Send the Market Research Handbook #101.

☐ Enclosed is my remittance of $15.00. Send the Handbook For Principals On Manufacturers' Representatives #102.

☐ Enclosed is my remittance of $30.00. Send the Advertising/Promotion Handbook #103.

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COMPUTERS FOR MAN

Relative to the increasing public concern for more applications of computers to human welfare, this year's Omaha State Fair provided a free lung check-up courtesy of two Univ. of Nebraska Medical Center physicians, the Nebraska State Tuberculosis and Respiratory Disease Assoc., and a Varian 620/i mini-computer. An exhibit at the fair invited visitors to fill-out a short questionnaire ("Do you smoke?", "Do you have a cold?", etc.) and exhale into a bellows device. By comparing this data with the data already in the mini's files, the doctors were able to tell the visitors in 90 seconds whether or not there were indications of lung problems that warranted further examination.

BIGGEST SIGMA

Sigma 9, the largest and most powerful of Xerox Data Systems' Sigma family, has been announced together with a new transaction-oriented operating system (XOS) for commercial applications and a new 1500 lpm printer (Model 7446). The new products were described as "representing an all-out bid by XDS for a larger share of the on-line commercial market." Sigma 9 is expandable to more than 2 megabytes of 900 nsec core memory (4 bytes/word/memory cycle). Real-time capability is provided by up to 12 memory access ports for as many as 11 independent I/O processors — each able to accommodate 32 peripheral devices at channel transfer rates to 900k bytes/sec. The system is fully compatible with previous Sigma peripherals and user programs, including those presently running under XDS' Universal Time-Sharing System (UTS). Deliveries of Sigma 9, which is typically priced at $1.7 million, are scheduled for late 1971.

ORDERS AND INSTALLATIONS

Deere & Company, Moline, Ill., manufacturers of farm and industrial equipment, has placed an order with Sperry Rand Corp. for 22 Univac 9200 and 9300 computers, valued at approximately $2.5 million. The computers will be installed over the next two years in Deere branch offices throughout the United States and Canada.

The Equitable Life Assurance Society of the United States has ordered two COMCET systems. Shipment will begin this week and be complete by January 15, 1971. The contract value is in excess of $2.1 million including hardware, software, and maintenance.

Century Data Systems, Anaheim, Cal., subsidiary of California Computer Products, Inc., has reached an agreement with Burroughs Corp. to supply over $25 million worth of computer disk drive memory systems over a three-year period.

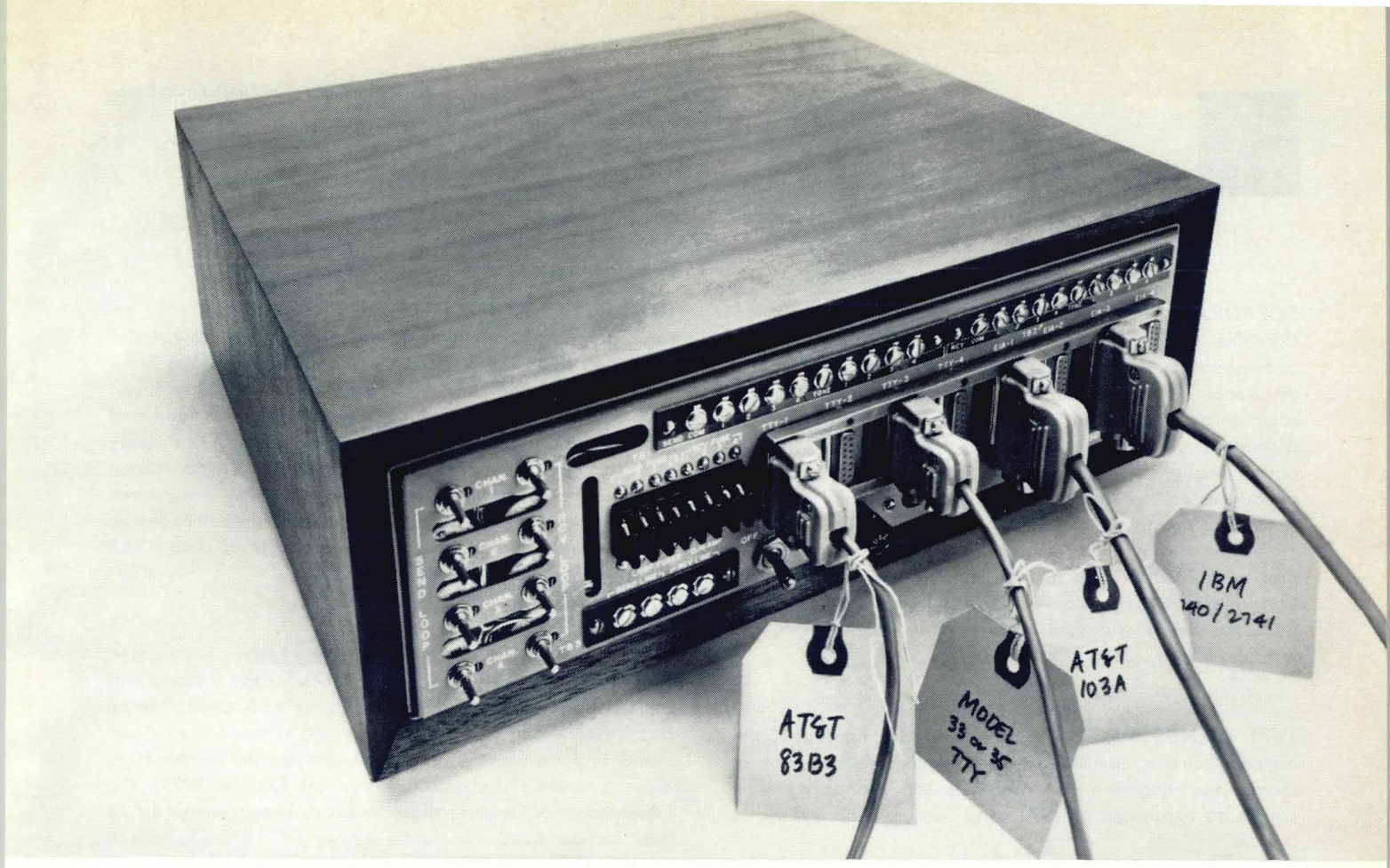
A $2.8 million contract has been awarded to Sperry Rand Corp. by the General Services Administration for a Univac 1108 computer system. It will be installed in April 1971 at the U.S. Army Material Command's Edgewood Arsenal.

Varian Data Machines has received two large computer orders totaling $2.1 million. A $1.1 million order was placed by Holmes Protection, Inc. for 620/f digital computers to be used in central station protection systems for banks and other business facilities. A $1 million order was also placed for R620/i computers to be installed in electronic test systems.

Telefile Computer Corp. announced it has received its first order for the company's DPE-411 management information system. Cox Data Systems, Inc., Atlanta, a subsidiary of Cox Broadcasting Corp., has ordered three Telefile systems valued at more than $2.5 million. First delivery is scheduled for August, 1971.

Burroughs Defense, Space and Special Systems Group, Paoli, Pa., has received an Air Force contract for the lease of six Burroughs Computer Output to Microfilm units. Total value of the equipment is $555,000.

Corpus Christi Bank & Trust in Corpus Christi, Texas, has ordered a Burroughs B3500 computer system valued at more than $823,000.



It lets you talk to your computer without running your phone bills sky-high.

With our Frequency Division Multiplexer you can link your computer and terminals with the least number of phone lines.

And at the least expense.

It's the only FDM that has 20 ma, 60 ma, and EIA interfaces standard in every unit. So it will interface with any terminal or computer on the market—which makes it real off-the-shelf stuff.

(That's one reason we can deliver a system in 30 days and have it running on the 31st.)

Our multiplexer is really a set of modems, each tuned to a different frequency. We make 4-channel and 1-channel units. So it's easy to set up an FDM system with the exact number of terminals you have at any location.

And you don't have to pay for any more equipment than you need.

At speeds of 110 baud, the system can handle up to 18 channels on a voice-grade line. It allows data transmission at speeds from 75 to 600 bps.

Once they're installed, there's no reason why our FDM's won't work forever. But if anything goes wrong, we have a nationwide service organization that will fix the trouble fast.

You can lease or buy our FDM system at very favorable prices. (One of our customers replaced his old system with ours at a saving of $3000 per month.)

Ultronic runs one of the world's largest communication systems. Since we sell a complete line of communication products, including video terminals, front-end processors and Time Division Multiplexers, we have no axe to grind when it comes to advising you on your multiplexing needs.

The kind of data you send from point to point is, of course, your business.

How to get it there cheaper is our business.

We'll explain if you call 609-235-7300. Or write: Ultronic Systems Corporation, Mount Laurel Industrial Park, Moorestown, N.J. 08057.

ULTRONIC SYSTEMS

General Telephone & Electronics

Harold V. Semling, Jr., Washington Editor

DC DATASCAN

CORPORATE NEGLIGENCE — The office of Congressman Cornelius E. Gallagher (D., N.J.) is being "deluged with examples of indifference, carelessness, and incredible arrogance on the part of those who are supposed to run computers in large organizations." Congressman Gallagher is sponsoring legislation "to relieve the consumer from corporate negligence in the use of the computer." In a recent announcement he stated: "There is an enormous legal lacuna surrounding the use of the computer which . . . may inhibit the very real social and economic benefits which its proper application can provide our Nation. Certainly the Congress must begin to bring forth legislation which reflects the simple fact that business firms are misusing the wonders of computer technology."

1971 TRENDS MIXED — Two U.S. Department of Commerce electronic computer industry specialists believe that "some persisting financial problems will probably inhibit corporate expansion in 1971, and raising capital may be difficult."

"A poor 1970 earnings record and a dulled glamour image for computer stock will make the equity market an unsatisfactory medium for raising funds, while continued high rates may restrain debt financing." James N. Carr and Stephen T. McClellan of Commerce's Scientific and Business Equipment Division said.

Domestic shipments are expected by them to pick up 15 percent in 1971, but the international market will most likely be a substantial growth market. Many U.S. computer and peripheral equipment firms are expected to become more international in character — i.e., more exporting and establishing more foreign subsidiaries.

FTC RULE — The Federal Trade Commission recently proposed rules on credit billing practices which, according to Senator Sam J. Ervin (D., N.C.), are "the first of many, many steps needed to protect individuals from the abuses of a computerized society." He called on the Nixon Administration "to look to the beam in its own eye and show at least as much initiative with respect to Federal computers and data banks." While it is encouraging to see the FTC "jumping on the bandwagon," administrative rules are no substitute for comprehensive statutory protection which government agencies are powerless to rescind, amend, or ignore," according to Sen. Ervin.

MEDICARE INCOME — Dr. J. Ernest Breed, President of the Illinois State Medical Society believes that IRS computer errors may account for the recent report that about 1,500 physicians failed to declare Medicare and Medicade income on their tax returns. Dr. Breed, according to the AP called for "full government disclosure of audits into doctors' records."

HAZARDOUS NOISE — Sometimes programmers make errors because of high noise levels in computer laboratories according to researchers at the National Bureau of Standards Institute for Basic Standards. A recent study found that "not only is the noise disruptive to concentration and communication, but in some cases the level is sufficienly high to cause permanent hearing damage." NBS recommended that computer personnel avoid noisy equipment. Also they should have their hearing measured frequently, and wear ear protection when the noise level is too high for normal conversation.

WWMCCS PROPOSALS — The Air Force has issued requests for proposals to 17 companies for the replacement and modernization of data processing equipment located at the fixed headquarters of the World Wide Military Command and Control System, and related Intelligence Handling Systems. Proposals are due by Feb. 1, 1971. The Department of Defense plans to procure a minimum of 15 new standardized computers during FY 1972-73, with a minimum of nine systems in FY 1972. Machine sizes will range from medium to large. DoD warned that "if proposals result in prices exceeding $46.2 million from all proposers for the hardware and software for the 15 systems, the government may re-examine its requirements, restate such requirements, cancel or amend the solicitation and resolicit proposals for its requirements."

GAO DP CENTER — A Data Processing Center (DPC) has been established in the Government Accounting Office (GAO). The center will, among other services: (1) Provide EDP services, including equipment operation, systems analysis, design, documentation, and programming to all organizations in the GAO; (2) Develop and maintain an integrated management information system for GAO; (3) Evaluate existing systems and procedures for the purpose of recommending specific application of computer-based systems and subsystems; (4) Conduct EDP project feasibility studies, developing project specifications and administering projects; (5) Advise on the acquisition and disposition of EDP equipment.

IN BRIEF

The U.S. Department of Agriculture has given a contract to Indiana State University to develop, test, and evaluate methods and procedures for using optical scanners in retail store checkout operations.

The Commerce Department's Economic Development Administration has awarded an $8,000 grant for a pilot program to train displaced North Carolina textile workers for job opportunities in data processing.

During October, U.S. Department of Agriculture experts met with state agriculture officials in Washington to explore ways of using EDP to improve the state organizations.

THE $2400 LINE PRINTER COMPANY IS ALSO THE $995 CRT COMPANY.

We priced our CRT like our printer. Very low.
And we built it the same way too. Very simply.
To be used on line and off line.
The model 301 features a 132 character display and
four special functions: Bell, Line Feed, Return and Delete.
At $995, it's all you need.
Centronics Data Computer Corp., Hudson, N.H. 03051

centronics

Because you don't want to spend more than you have to.

CIRCLE NO. 18 ON INQUIRY CARD

INTERNATIONAL NEWS

COMPUTER BUYING — The Bonn Government in Germany is acquiring computers. In late 1969 it had some 150 computers in operation. Since then, the number has risen to 174 with another 86 to be delivered before the end of 1970. Plans beyond 1970 call for still more electronic brains, according to the **Journal of Commerce**. It is estimated that soon the government will have a staff of 6,000 to operate the computers. The biggest single computer user is the Federal Postal and Telecommunications Office with 43 machines. The Transport Ministry has 41; the Ministry of Economics has 10; and the Ministry of Interior has 7.

CANADA'S ROADS — Computer systems help engineers in the Canadian Department of Public Works to design and build national park roads. A contract has been given to Spartan Air Services Ltd. to produce "orthophotographic maps," from aerial photographs. The computer automatically reads the photographs and produces information which will assist the engineers in road routing.

FAVORABLE OUTLOOK — The U.S. Department of Commerce's Bureau of International Commerce believes that the Canadian market looks promising for U.S. EDP sales. Favorable factors are: the Canadian economy's projected average annual growth rate of 5% through 1973; slack competition in the EDP market; a stimulating effect on imports as a result of the Government's decision to "float" the Canadian dollar. U.S. firms now supply about 93 percent of Canada's total EDP imports.

E. EUROPEAN EXPORTS — Among the principal commodities licensed for export to Eastern European countries by the U.S. Department of Commerce in the second quarter of 1970 were computers and peripherals ($5.5 million, including $1.6 million to the U.S.S.R., $1.1 million to East Germany, and $0.9 million to Czechoslovakia).

COMPUTERS FOR SHIPPING — The Panama Canal Co., a U.S. Government agency, is considering computerized controls for its 50-mile waterway. Computer Sciences Corp. has been awarded a contract to study the possibility. It is believed that with computerized information traffic capacity and consequently toll revenue might increase. The study report is due by May 1971.

TOOLS OF REPRESSION — Computers could become a horrifying tool for prying and repression, a group of international lawyers warned recently. At a Brussels meeting sponsored by the prestigious Council of Europe, the assembly expressed fear about technological threats to civil liberties, such as data banks, hidden microphones, and infrared cameras. In the conference's conclusion the lawyers said: "New threats to the individual and his private life have arisen out of modern techniques. The computer, which is unversally recognized as a magnificent instrument for management and data processing, can, in the hands of unscrupulous authorities become a horrifying tool for prying and repression."

ISRAEL MARKET — U.S. Department of Commerce's Bureau of International Commerce forecasts rapid expansion of Israel's EDP market. This growth is expected as the result of a booming economy and a determined effort to maximize efficiency. Civilian EDP, now valued at about $13 million, is expected to advance about 30 percent a year. Imports have furnished almost all of Israel's EDP market. Local output, while small, is growing and is largely directed to export. Numerous small computers are being exported to Western Europe. About 40 percent of Israel's imports come from the U.S., with the rest coming from firms in Germany, France, and the United Kingdom. Virtually all the firms are American-backed.

QUICKLY AROUND THE WORLD

Citroen, the French car manufacturer, is to install seven NCR Century series computers, worth over $1,200,000. The NCR machines will be produced in Dundee, Scotland.

Standard Telephones and Cables, London, has received an order from the British Post Office for Datel Modems worth $2.4 million.

IBM has more than half of the computers in the European Economic Community. Based on 1969 data, IBM is followed by GE-Bull, whose greatest share is in Italy.

Computer hardware and software are major potential growth sectors in Germany and the government is increasing its expenditures for research and development in data processing from DM 86 million in 1970 to DM 423 million by 1974 (U.S. $1.00 = DM 3.66), the American Embassy in Bonn reports.

If you lack a peripheral, we'll supply it. Anywhere in the world.

We are International Computers (USA) Limited, a wholly-owned subsidiary of International Computers Limited. We are also the largest Systems Manufacturer in the world, outside the USA, and are represented in more than 70 countries. As a result of ICL's rapidly growing international acceptance as an OEM supplier, a large number of leading computer manufacturers incorporate ICL ancillary and peripheral equipment in their products. The United States is one of ICL's most valued sales-sources. Our new American Company is proof of our faith in this, the most significant of all computer markets.

Our OEM headquarters at 839 Stewart Avenue, Garden City, New York, has a large range of equipment to meet your peripheral needs. And if we haven't got exactly what you want—let us know what your exact OEM requirements are. Pictured are just a few of the outstanding ICL OEM peripherals available for your call:

Model 9 Tape Transport. Fully automatic loading with speed ranges from 112½" to 200" per second. Low maintenance cost.

Model 8 Tape Transport. Fully automatic loading with speed ranges from 37½" to 75" per second. High reliability.

Model 667 Line Printer. For data communications terminal or high-speed printout. Line speed from 150 to 800 per minute. 80 to 136 print positions.

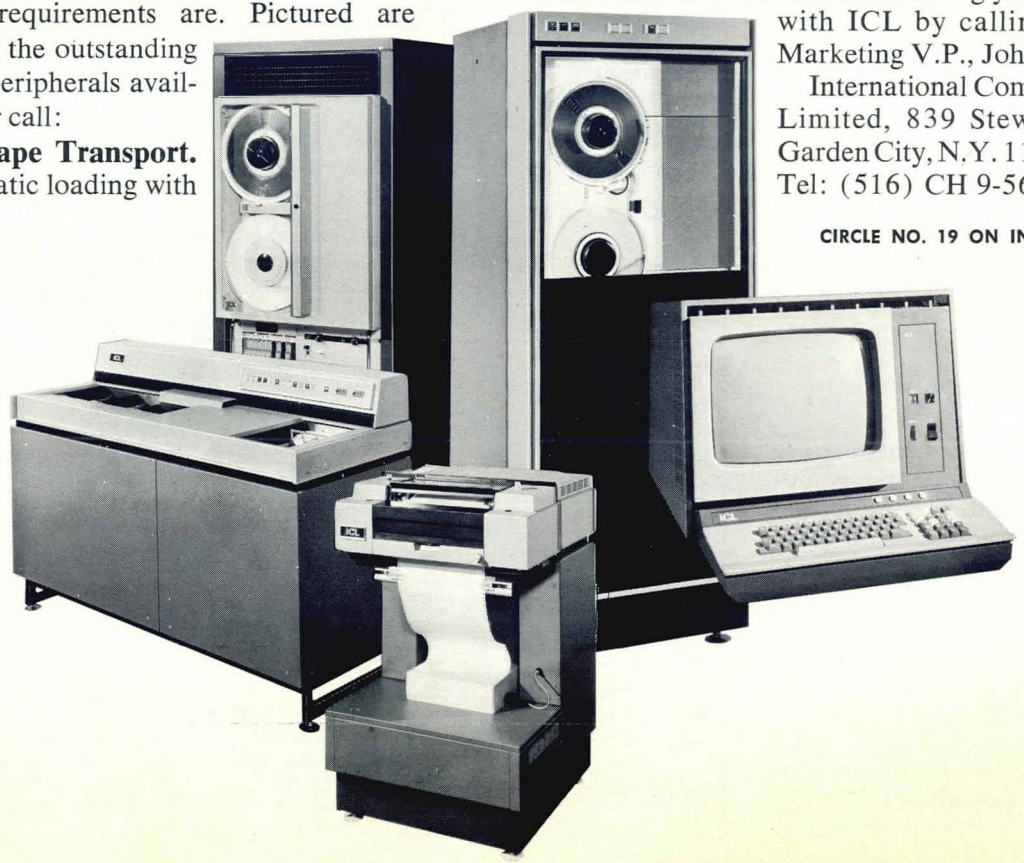
Jet Stream Document Transport. For OMR, OCR or MICR reading heads. Up to 1,000 documents per minute on demand.

Model 7871 CRT Keyboard Display Unit. Up to 2,000 characters. Full editing capability. Upper or lower case 96 character set.

We have built a strong, competitive OEM global sales record. Ask our deeply committed customers about that record. And start building your own record with ICL by calling our OEM Marketing V.P., John Barber.

International Computers (USA) Limited, 839 Stewart Avenue, Garden City, N.Y. 11530
Tel: (516) CH 9-5656 **ICL**

CIRCLE NO. 19 ON INQUIRY CARD



CORPORATE AND FINANCIAL NEWS

DATRAN DROPS SATELLITE PLANS

Datran (Data Transmission Co.) has abandoned its plans to construct a large-scale multi-purpose domestic satellite communications system. Datran has previously advised the FCC that it would file applications for the system as part of a consortium made up of itself, Raytheon, and Lockheed. In announcing the shift in plans, Datran president David H. Foster stated that while Datran's market survey "cast considerable doubt on the economic viability of a domestic satellite system for some years to come," the company's current plans do not preclude filing a satellite application at a later date.

$80 MILLION IN 3 WEEKS FOR RCA

Three weeks after debuting its new family of four computers with a guaranteed conversion policy for present IBM S/360 users, RCA announced receipt of more than $80 million in sales or lease orders for the new RCA 2, 3, 6, and 7 systems. L. E. Donegan, Jr., V.P. and gen'l mgr. of RCA's EDP Division, noted that about one third of the new orders represent customers coming to RCA for the first time, "the majority of them from IBM."

PRICE REDUCTIONS

Typical of the substantial price cuts being announced by equipment manufacturers: **Cybercom Corp.** has reduced the lease price on its Mark I key-to-cassette encoder system by up to 22%. . . . **Datum, Inc.** has slashed the price of its mini-drum memory to under $1,000, a reduction of approximately $1,500. . . . **Systems Engineering Laboratories'** Model 810B computer with 4K of core and TTY has been reduced from $33,500 to $31,000.

RECENT ENTRIES IN THE COMPUTER FIELD: **ACI Systems, Corp.**, Chicago, Ill., will offer automatic transportation equipment identification scanners and label-decoding processors . . . Officers of **Communicators, Inc.**, a newly-formed mktg. communications agency based in Nashua, N.H., include former adv./p.r. mgrs. from Honeywell, Sanders Assoc., and DEC . . . **Courtney/Peters,** a joint venture of the Larry Courtney Co. of Encino, Cal. and David L. Peters Assoc., of Ho-Ho-Kus, N.J., will specialize in providing mktg. assistance to electronic and computer-oriented firms . . . **International Computers (USA) Ltd.**

BOX SCORE OF EARNINGS

Company	Period		Revenues	Net Earnings (Loss)	Earnings (Loss) Per Share
Beckman Instruments	3 mos.	9/30/70	31,124,000	862,213	.25
	3 mos.	9/30/69	31,640,546	875,411	.25
Burroughs	9 mos.	9/30/70	619,594,000	36,884,000	2.14
	9 mos.	9/30/69	517,229,000	30,242,000	1.83
CalComp	Yr.	6/30/70	27,616,000	807,000	.35
	Yr.	6/30/69	20,474,000	960,000	.43
Computer Communications	Yr.	6/30/70	8,763,019	57,967	.05
	Yr.	6/30/69	6,832,055	(82,576)	(.08)
Computer Sciences	26 wks.	9/25/70	52,783,000	2,519,000	.20
	26 wks.	9/26/69	48,863,000	5,698,000	.45
Computest	3 mos.	8/31/70	2,360,038	136,169	.15
	3 mos.	8/31/69	1,868,072	112,270	.12
Data Packaging	9 mos.	8/29/70	10,688,712	479,370	.29
	9 mos.	8/29/69	10,454,970	860,599	.55
Electronic Controls	9 mos.	9/30/70	1,140,000	56,000	.17
	9 mos.	9/30/69	880,000	25,000	.08
Foxboro	9 mos.	9/30/70	105,552,000	3,162,000	.75
	9 mos.	9/30/69	87,491,000	2,933,000	.69
Honeywell	9 mos.	9/30/70	1,091,600,000	40,300,000	2.57
	9 mos.	9/30/69	1,009,800,000	39,800,000	2.65
Keydata	Yr.	7/31/70	4,359,000	(686,000)	(.38)
	Yr.	7/31/69	2,456,000	(1,756,000)	(1.52)
Nat. Cash Register	9 mos.	9/30/70	991,257,000	28,113,000	1.31
	9 mos.	9/30/69	881,993,000	27,645,000	1.29
Optical Scanning	3 mos.	9/30/70	1,425,859	(348,772)	(.64)
	3 mos.	9/30/69	2,678,875	146,894	.27
Planning Research	Yr.	6/30/70	64,924,849	3,553,363	.72
	Yr.	6/30/69	58,745,978	3,005,273	.66
RCA	9 mos.	9/30/70	2,377,100,000	54,400,000	.75
	9 mos.	9/30/69	2,471,600,000	110,600,000	1.59
Sanders Assoc.	Yr.	7/31/70	173,600,000	782,000	.17
	Yr.	7/31/69	187,100,000	(1,950,000)	(.43)
Sperry Rand	6 mos.	9/30/70	836,562,000	34,247,000	1.00
	6 mos.	9/30/69	809,739,000	34,560,000	1.01
Systems Engrg. Labs.	Yr.	6/26/70	21,153,000	1,873,000	.82
	Yr.	6/27/69	17,298,000	1,453,000	.70
Tab Products	3 mos.	8/31/70	4,940,000	259,000	.31
	3 mos.	8/31/69	5,001,000	145,000	.17
Vernitron	6 mos.	6/27/70	21,913,984	400,139	.12
	6 mos.	6/28/69	22,953,995	1,633,934	.53
Wang Labs.	3 mos.	9/30/70	7,748,012	712,459	.18
	3 mos.	9/30/69	5,466,228	541,188	.14

has been formed as a wholly-owned subsidiary of International Computers Ltd. to develop the ICL U.S. activities (OEM sales to American computer manufacturers and technical liaison with American suppliers) previously carried on by ICL's U.S. branch . . . **The McDonnell Douglas Automation Co.** will function as a separate computer services division of parent McDonnell Douglas Corp. . . . Bechtel Corp. has established **Pacific International Computing Corp.** in San Francisco to offer computer services to Bechtel clients and other professional and industrial firms . . . **Pacific Real Time Systems, Inc.** (PARTS) has been formed in L.A. as an advisory and consulting service in the telecommunications industry.

MERGERS AND ACQUISITIONS: **California Computer Products, Inc.** and **Century Data Systems, Inc.** have agreed to a plan for CalComp to acquire full ownership of Century Data, presently a 65 percent owned subsidiary. . . . Two El Paso EDP firms, **Financial Computer Services, Inc.** and **Automated Data Processing, Inc.**, have agreed to merge with **National Sharedata Corp.** of Dallas. Both FCPI and ADPI are wholly-owned subsidiaries of **Coaches of America, Inc.**, also located in El Paso . . . **Samsonite Corp.** has acquired **Electronic Processors, Inc.**, a recently-formed manufacturer of mini-computers and tape cassette decks. EPI expects its first product, a 4K x 18-bit mini designated the EPIC-118, to be available around the turn of the year . . . **Pryor Computer Industries'** Time-Sharing Division and **Tim, Inc.**, both located in Chicago, will be merged to form Pryor-Tim, Inc. The Pryor firm and Tim will each own 50% of the new company.

COMPUTER STOCK TRENDS

MONTH ENDED NOVEMBER 13, 1970

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1970 RANGE (1)	1 YEAR AGO	CLOSE NOV. 13, 1970	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG. VOLUME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
COMPUTERS	N	BECKMAN	19- 52	59 1/4	23 1/8	-4 3/4	-17.0	1365	2353	1742	1.43	16
	N	BURROUGHS	80-173	152 7/8	105 5/8	-11 7/8	-10.1	8956	8055	9198	3.63	29
	N	CONTROL DATA	30-123	117 3/8	42	-6 3/8	-13.1	7762	10427	8633	1.28	33
	O	DATA GENERAL	16- 36	N/A	26 1/2	-7	-20.8	(3)	-	-	0.28	95
	O	DATACRAFT	5- 19	N/A	6 1/4	-2 1/4	-26.4	(3)	-	-	-	-
	A	DIGITAL EQUIPMENT	50-124	95 1/2	54 7/8	-22 1/8	-28.7	8899	5575	6091	1.49	37
	N	ELECTRONIC ASSOC	4- 12	16 5/8	4 3/8	-1 5/8	-27.0	611	1215	818	-2.63	-
	O	GENERAL AUTOMATION	9- 42	N/A	12	-2 3/4	-18.6	(3)	-	-	-1.03	-
	N	GENERAL ELECTRIC	60- 88	84 1/4	85	+ 5/8	+0.7	8279	6764	8144	1.99	43
	N	HEWLETT-PACKARD	19- 46	52 1/8	25 1/4	-2 5/8	-9.4	3712	4958	3734	0.98	26
	N	HONEYWELL	66-152	147 1/2	70 3/4	-14 7/8	-17.3	6848	4054	4851	4.07	17
	O	INTERDATA	3- 13	N/A	6 3/4	-3 1/2	-34.1	(3)	-	-	-	-
	N	IBM	223-387	364 1/2	293 1/8	-3	-1.0	7283	7981	9552	8.68	34
	N	LITTON INDUSTRIES	15- 38	53 5/8	19 1/2	-4 5/8	-19.1	9243	14090	12051	1.85	11
	N	NCR	30- 63	74	33 5/8	-7 7/8	-18.9	9542	11145	8125	2.08	16
	N	RCA	18- 35	40 5/8	23 1/2	-2 3/8	-9.1	7275	5300	8243	1.48	16
	N	RAYTHEON	16- 34	37 1/2	20 5/8	-2 5/8	-11.2	1972	3161	3144	2.35	9
	O	REDCOR	4- 34	27	5 3/8	-1 3/8	-20.3	(3)	-	-	0.17	32
	O	SCIENTIFIC CONTROL	2- 9	18 3/4	1 1/2	-1 1/4	-45.4	(3)	-	-	-2.44	-
	N	SPERRY RAND	19- 40	44 7/8	22 1/8	-4 3/8	-16.5	11045	13082	10376	2.36	9
	A	SYSTEMS ENGRG LABS	11- 49	48 3/8	15 1/2	-3 3/4	-19.4	7555	10836	5759	0.78	20
	N	SYSTRON DONNER	8- 29	30 1/2	9	-2 1/4	-20.0	2572	835	712	0.82	11
	N	VARIAN ASSOCIATES	10- 29	32 3/8	11 3/4	-4 1/4	-26.5	2142	5413	4245	0.85	14
	O	VIATRON	3- 51	N/A	3 3/8	-1 3/8	-28.9	(3)	-	-	-3.38	-
	A	WANG LABS	19- 52	53 3/4	30 5/8	-1 3/4	-5.4	1360	1446	2009	0.81	38
	A	WYLE LABS	3- 10	11 1/8	4 1/4	-1	-19.0	470	857	853	0.01	425
	N	XEROX	66-116	105 3/4	83	-3	-3.4	12983	14507	16026	2.33	36
PERIPHERALS & COMPONENTS	N	AMP	41- 57	56 3/4	52 3/8	+1 5/8	+3.2	1274	1464	2463	2.01	26
	N	AMPEX	13- 49	47 1/8	16	-2 5/8	-14.0	5153	8076	5668	1.10	15
	O	APPLIED MAGNETICS	9- 26	18	14 3/4	- 3/4	-4.8	(3)	-	-	0.52	28
	O	ASTRODATA	2- 35	N/A	2 1/8	-5 3/4	-73.0	(3)	-	-	-	-
	O	ASTROSYSTEMS	2- 9	6 1/2	4 3/4	+1 1/8	+31.0	(3)	-	-	-	-
	N	BUNKER RAMO	6- 15	15 1/8	8 5/8	- 7/8	-9.2	2473	4363	3943	0.49	18
	A	CALCOMP	11- 34	31 1/2	29 1/8	+3 1/8	+12.0	10993	7880	4575	0.49	59
	O	CHALCO INDUSTRIES	2- 5	N/A	1 3/4	- 1/4	-12.5	(3)	-	-	-	-
	O	CODEX	3- 35	N/A	6 1/8	-3 1/2	-36.3	(3)	-	-	-	-
	O	COGAR	37- 94	N/A	52	-2	-3.7	(3)	-	-	-	-
	O	COGNITRONICS	3- 14	17 1/4	5 5/8	-3 1/8	-35.7	(3)	-	-	-0.30	-
	N	COLLINS RADIO	10- 37	56 1/2	13	-3 3/4	-22.3	1268	2689	2031	0.15	87
	O	COMCET	5- 50	N/A	5 1/4	-2 1/4	-30.0	(3)	-	-	-	-
	O	COMPUTER COMM	6- 36	N/A	6	-7	-53.8	(3)	-	-	-0.14	-
	O	COMPUTER CONSOLES	6- 22	20 1/2	6 1/2	-1 1/4	-16.1	(3)	-	-	-	-
	A	COMPUTEST	12- 28	28 1/2	12	-6 5/8	-35.5	688	829	519	0.95	13
	N	CONRAC	11- 32	38 1/4	12 1/2	-3 1/2	-21.8	323	684	428	1.00	13
	O	DATA 100	5- 17	N/A	7	+ 1/4	+3.7	(3)	-	-	-	-
	A	DATA PRODUCTS	5- 26	19 1/4	6 1/2	-1 3/4	-21.2	(3)	-	-	0.25	26
	O	DATARAM	3- 16	N/A	3 1/4	-2	-38.0	(3)	-	-	-	-
	O	DATASCAN	5- 27	22	5	-3	-37.5	(3)	-	-	-	-
	O	DIGITRONICS	4- 14	16 1/2	4	-1	-20.0	(3)	-	-	0.07	57
	A	ELEC ENG OF CAL	4- 15	17 1/8	4 1/2	-2 1/8	-32.0	78	284	176	-0.20	-
	N	ELEC MEMORIES + MAG	7- 40	27 3/4	8 3/4	-3 1/8	-26.3	9726	17004	6611	0.13	67
	N	EXCELLO	17- 28	25 1/2	18 5/8	-1 1/2	-7.4	804	1649	903	2.22	8
	O	FABRI-TEK	2- 8	8	2 1/4	-1 5/8	-41.9	(3)	-	-	-0.09	-
	O	FARRINGTON MFG	2- 17	20 1/4	2 1/2	- 3/8	-13.0	(3)	-	-	-1.46	-
	A	GERBER SCIENTIFIC	9- 39	23	11 1/2	-6 1/4	-35.2	505	192	400	0.86	13
	O	GRAPHIC SCIENCES	8- 42	40 1/2	16 3/4	-7	-29.4	(3)	-	-	-1.56	-
	A	HI-G	6- 17	15	5 1/2	-1 1/2	-21.4	(3)	-	-	0.25	22
	O	INFORMATION DISPLAYS	4- 20	18 1/2	6 1/2	-1 3/4	-21.2	(3)	-	-	-	-
	A	ITEL	6- 26	N/A	16 5/8	+3 1/8	+23.1	(3)	-	-	0.90	18
	O	LOGIC	4- 14	15	4 1/2	-1 1/8	-20.0	(3)	-	-	-	-
	A	MILGO	15- 41	27 1/4	27 1/2	-8 5/8	-23.8	9619	15312	11927	1.00	28
	N	MOHAWK DATA SCIENCES	19- 87	77	23 1/2	-11 7/8	-33.5	10084	5525	6540	1.52	15
	O	NORTH ATLANTIC IND	3- 8	9	2 1/2	- 3/4	-23.0	(3)	-	-	0.70	4
	O	OPTICAL SCANNING	11- 52	57	16 1/2	-3	-15.3	(3)	-	-	-0.54	-
	A	POTTER INSTRUMENTS	15- 43	39 5/8	18	-4	-18.1	2265	1956	3269	0.90	20
	O	RECOGNITION EQUIP	13- 84	71 1/2	14	-5	-26.3	(3)	-	-	0.38	37
	N	SANDERS ASSOCIATES	7- 30	29 1/8	11 1/8	-4 5/8	-29.3	1355	2372	1535	0.17	65
	N	SANGAMO	9- 29	31 1/4	13 3/4	-2 1/8	-13.3	1624	1872	1201	0.46	30
	O	SCAN-DATA	5- 53	34	5 1/2	-1 1/8	-16.9	(3)	-	-	-	-
	A	SEALECTRO	4- 13	10 1/2	4 1/2	-2	-30.7	140	185	236	0.21	21
	O	SYKES DATATRONICS	2- 9	N/A	2 3/8	-1 1/8	-32.1	(3)	-	-	-	-
	O	TALLY	10- 23	22 1/2	12 1/2	-3	-19.3	(3)	-	-	0.21	60
	N	TELEX	10- 26	16 1/8	19 5/8	-1 1/8	-5.4	55255	57073	32112	0.99	20
	N	TEXAS INSTRUMENTS	62-135	125 5/8	71 1/2	-4 1/2	-5.9	3345	2881	4002	3.08	23
	O	VARIFAB	1- 5	7 3/4	2 1/4	-1 1/8	-33.3	(3)	-	-	-	-

FOOTNOTES: (1) TO NEAREST DOLLAR
(2) AVERAGE MONTHLY TRADING VOLUME SINCE JANUARY 1, 1970
(3) VOLUME IS NOT REPORTED FOR OVER-THE-COUNTER ISSUES AND NEW LISTINGS

EXCH: N=NEW YORK EXCHANGE; A=AMERICAN EXCHANGE; O=OVER-THE-COUNTER; L=NATIONAL EXCHANGE; T=TORONTO EXCHANGE

All statistics compiled, computed and formatted by TRADE*QUOTES Inc., Cambridge, Mass. 02139

TRADE*QUOTES

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1970 RANGE (1)	1 YEAR AGO	CLOSE NOV. 13, 1970	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG. VOLUME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
SOFTWARE & SERVICES	A	APPLIED DATA RESCH	4- 24	24 1/2	6	-1 1/4	-17.2	268	847	860	-0.31	-
	O	APPLIED LOGIC	1- 19	N/A	1 3/8	- 5/8	-31.2	(3)	-	-	-	-
	O	ARIES	1- 8	10 1/2	2 1/4	- 3/8	-14.2	(3)	-	-	-	-
	A	AUTOMATIC DATA PROC	22- 48	36 5/8	41 5/8	+2	+5.0	1940	2646	3711	0.70	59
	O	BOLT, BERANEK, NEWMA	6- 11	15 3/4	6 5/8	-1 7/8	-22.0	(3)	-	-	0.32	21
	O	BOOTHER COMPUTER	8- 26	30	12 1/4	-1 1/4	-9.2	(3)	-	-	1.57	8
	O	BRANDON APPLIED SYS	1- 10	10 1/4	1 3/8	+ 3/8	+37.5	(3)	-	-	-	-
	O	COMP ENVIRONMENTS	2- 14	N/A	1 3/4	-1 1/8	-39.1	(3)	-	-	-	-
	O	COMPUTER EXCHANGE	3- 8	11 3/4	5	- 1/2	-9.0	(3)	-	-	-	-
	A	COMPUTER INVESTORS	4- 12	13 5/8	7 1/8	-1 3/4	-19.7	154	428	284	0.57	1
	O	COMPUTER METHODS	1- 3	N/A	5/8	+ 1/8	+25.0	(3)	-	-	-	-
	O	COMPUTER PROPERTY	5- 15	N/A	5	- 3/4	-13.0	(3)	-	-	-	-
	N	COMPUTER SCIENCES	6- 34	31 3/4	10 1/4	-1 5/8	-13.6	7273	16426	10860	0.16	64
	O	COMPUTER TECHNOLOGY	2- 13	N/A	5 3/8	-1 7/8	-25.8	(3)	-	-	-	-
	O	CTC COMPUTER	1- 19	N/A	2 1/2	- 3/4	-23.0	(3)	-	-	-	-
	O	COMPUTER USAGE	2- 9	17	3 7/8	- 3/8	-8.8	(3)	-	-	1.81	2
	A	COMPUTING + SOFTWARE	18- 76	69 1/8	28	-3 1/8	-10.0	2044	2348	2059	1.32	21
	O	COM-SHARE	3- 15	N/A	3 7/8	+ 1/4	+6.8	(3)	-	-	-	-
	O	CYBERMATICS	5- 14	10	7 7/8	-1 7/8	-19.2	(3)	-	-	-	-
	O	DATA AUTOMATION	1- 24	N/A	1 7/8	- 5/8	-25.0	(3)	-	-	-	-
	O	DATA DYNAMICS	1- 4	N/A	1 1/8	- 5/8	-35.7	(3)	-	-	-	-
	N	DATA PROC FIN + GEN	7- 32	36 1/2	11 3/8	-3 1/2	-23.5	3328	6045	3449	0.36	32
	O	DATA SYSTEMS ANALYST	1- 6	N/A	2 1/4	- 1/4	-10.0	(3)	-	-	-	-
	O	DATRONIC RENTAL	2- 8	8 1/2	3	-1	-25.0	(3)	-	-	-	-
	A	DEARBORN COMPUTER	10- 24	28	20 1/8	+ 5/8	+3.2	410	476	601	1.47	14
	O	DECISION SYSTEMS	1- 4	4	1 1/4	- 1/4	-16.6	(3)	-	-	-	-
	O	DIGITAL APPLICATIONS	2- 7	7	1 3/4	-1 1/4	-41.6	(3)	-	-	-	-
	O	DIGITEK	1- 5	N/A	1 3/8	- 3/8	-21.4	(3)	-	-	-	-
	A	DPA, INC	3- 10	11 1/4	4 1/4	-1 1/8	-20.9	436	1224	670	0.69	6
	O	EFFICIENT LEASING	2- 5	4 1/2	1 1/2	- 1/4	-14.2	(3)	-	-	-	-
	A	ELEC COMP PROG INST	3- 12	11 5/8	4	-1	-20.0	222	621	377	0.02	200
	O	ELEC DATA SYSTEMS	31-161	140	56	-7 1/2	-11.8	(3)	-	-	0.61	92
	A	GREYHOUND COMPUTER	5- 14	17	6 5/8	-1 7/8	-22.0	289	382	342	0.76	9
	O	INFORMATICS	4- 21	N/A	6	-2 3/4	-31.4	(3)	-	-	0.04	150
	O	INTL COMPUTER	1- 8	11 1/4	3	-1	-25.0	(3)	-	-	-	-
	L	INTL COMPUTER SCI	1- 3	N/A	1 1/8	0	0.0	(3)	-	-	-	-
	N	LEASCO	7- 31	27 3/4	10 1/2	-3 1/2	-25.0	6040	14821	7463	1.86	6
	O	LEVIN-TOWNSEND	3- 19	25 1/2	5 1/2	- 5/8	-10.2	(3)	-	-	-1.29	-
	O	LMC DATA	1- 4	3 3/4	1 1/8	- 1/2	-30.7	(3)	-	-	-0.52	-
	O	MGMT ASSISTANCE	1- 4	3 3/4	1 1/8	- 1/2	-30.7	(3)	-	-	-2.57	-
	A	MANAGEMENT DATA	8- 26	23 3/8	9 3/8	-4	-29.9	220	270	237	0.73	13
	O	NATIONAL COMP ANAL	1- 9	7 3/4	2 1/4	- 1/2	-18.1	(3)	-	-	-	-
	N	PLANNING RESEARCH	14- 53	48 3/8	17 3/4	-4 1/4	-19.3	3090	3397	2975	0.72	25
	O	PROGRAMMING METHODS	9- 27	17	15 1/2	+ 1/2	+3.3	(3)	-	-	-	-
	L	PROGRAMMING SCIENCES	2- 17	18 1/2	1 3/4	- 1/4	-12.5	(3)	-	-	-	-
	C	PROGRAMMING SYSTEMS	2- 6	5 1/4	2	- 1/4	-11.1	(3)	-	-	0.14	14
	O	SCIENTIFIC COMPUTER	1- 4	3 3/4	2 1/8	+ 1/2	+30.7	(3)	-	-	0.11	19
	N	SCIENTIFIC RESOURCES	2- 15	16	3 5/8	-1 1/4	-25.6	2551	8570	3955	-0.98	-
	O	SYSTEMS CAPITOL	1- 8	6	2 1/2	- 3/4	-23.0	(3)	-	-	-	-
	O	TIME SHARE	1- 7	N/A	1 1/4	- 3/8	-23.0	(3)	-	-	-	-
	O	TRACOR COMPUTING	2- 8	N/A	1 3/4	- 7/8	-33.3	(3)	-	-	-0.89	-
	A	URS SYSTEMS	5- 21	N/A	7 1/4	+ 3/8	+5.4	(3)	-	-	0.41	18
	O	UNITED DATA CENTERS	2- 5	4 3/4	2	- 3/4	-27.2	(3)	-	-	-	-
	N	UNIVERSITY COMPUTING	14- 99	105 1/8	20	-11 3/8	-36.2	20802	26311	14885	0.97	21
	O	US TIME SHARING	2- 14	N/A	2 1/8	-4 1/8	-66.0	(3)	-	-	-	-
SUPPLIES & ACCESSORIES	N	ADAMS MILLIS	8- 15	16	12 1/2	-1 1/8	-8.2	366	718	437	1.19	11
	O	BALTIMORE BUS FORMS	7- 21	N/A	7	-2 1/4	-24.3	(3)	-	-	-	-
	A	BARRY WRIGHT	6- 25	25 1/8	7 5/8	-2 3/4	-26.5	335	944	586	0.62	12
	A	CAPITOL INDUSTRIES	15- 54	52 3/4	14 5/8	-6	-29.0	1653	4306	1571	1.44	10
	A	DATA DOCUMENTS	15- 36	35 1/2	17 1/4	-2 1/4	-11.5	62	110	117	1.82	9
	O	DATA PACKAGING	5- 29	29 1/4	6	-2 1/4	-27.2	(3)	-	-	0.51	12
	N	DENNISON MFG	11- 25	28 1/2	18	-1 1/2	-7.6	1953	1628	1324	1.54	12
	N	DUPONT	93-128	119 3/8	118 3/4	+2 3/4	+2.3	3729	3209	3905	7.02	17
	N	ENNIS BUSINESS FORMS	10- 19	19 1/4	10 1/4	-1 3/4	-14.5	378	401	301	0.92	11
	O	GENERAL BINDING	14- 31	33 1/2	24 1/2	+1 1/2	+6.5	(3)	-	-	0.84	29
	O	GRAPHIC CONTROLS	7- 17	21 3/4	7 3/8	-2 1/8	-22.3	(3)	-	-	0.27	27
	O	LEWIS BUSINESS FORMS	11- 20	16 3/4	12 1/2	+ 1/4	+2.0	(3)	-	-	0.91	14
	N	MEMOREX	46-167	156	73 5/8	-9 3/8	-11.2	11600	17842	12891	2.08	35
	N	3M	72-115	118	86 1/4	-1 3/4	-1.9	11636	5232	5619	3.31	26
	T	MOORE CORP LTD	27- 38	N/A	32	-2	-5.8	(3)	-	-	-	-
	O	REYNOLDS + REYNOLDS	25- 49	42 1/2	38	- 3/4	-1.9	(3)	-	-	1.48	26
	A	SAFEGUARD INDUSTRIES	7- 16	16 3/4	8 7/8	- 1/2	-5.3	522	611	501	0.81	11
	O	STANDARD REGISTER	17- 31	27 3/4	18	-1	-5.2	(3)	-	-	1.98	9
	N	UARCO	22- 39	34 3/4	23	-5	-17.8	164	118	194	2.16	11
	O	WALLACE BUS FORMS	17- 41	18 1/4	17 3/8	-1 1/8	-6.1	(3)	-	-	1.16	15

AVERAGES								
	COMPUTER STOCKS	12–36	38.97	17.33	–2.47	–12.5		0.83	20.8
	DOW JONES INDUSTRIALS	631–811	860.48	759.79	–8.9	–1.2		3.26	14.2

CORPORATE PROFILE

Featured this Month:

UNITED DATA CENTERS, INC. (over-the-counter)

100 Putnam Green
Greenwich, Conn. 06830

DIRECTORS: **Bernard Goldstein,** President; **Albert A. Eisenstat; Michael Roth; Arthur I. Sarnoff; Daniel Rosenbloom; Mark S. Handler.**

BACKGROUND: United Data Centers, Inc. is a network of commercial data processing centers. It was incorporated in 1967; ownership became public the following year. Since its inception the company has acquired six data centers as well as Sports Data, an organization specializing in computerized golf handicapping and billing for country clubs. UDC is currently operating at an annualized rate of $3½ million. UDC has a unique marketing philosophy which emphasizes relatively small metropolitan areas where need is considerable, but where competition has not developed to the level of larger areas. Also, UDC prefers to expand through acquisition of ongoing businesses.

FACILITIES: Corporate offices are located in Greenwich, Connecticut. Data centers are located in Salem and West Springfield, Massachusetts; Syracuse, New York; Birmingham and Decatur, Alabama; Benton Harbor, Michigan; and Miami, Florida.

PRODUCTS/SERVICES: The product line includes industry-oriented application packages and several proprietary program packages of a classical nature (e.g., accounts receivable, payroll). Considerable emphasis has been given to marketing Computafuel, UDC's unique proprietary computerized service for the fuel oil distribution industry. The company is the leader in servicing this industry. More than 300,000 homes (i.e., 2% of U.S. total) are heated with oil burners monitored by Computafuel. Complementary systems are under development and will be introduced shortly.

CURRENT POSITION: During the first half ended June 30, 1970, UDC's earnings were $0.08 per share, up from a loss of ($0.05) for the similar period in 1969. Operating revenues for the same period were $1,386,423, up from $865,347. Figures for the six months ended 6/30/69 have been adjusted to eliminate loss from a subsidiary sold on 12/31/69.

OUTLOOK: United Data Centers, Inc. is forecasting continuing profitability for the two remaining quarters of the year, which will be the best year in the company's history. UDC is in a strong cash position, has no debt, and is continuing its acquisition program as well as the development of new proprietary computer packages. UCD is the only company concentrating on secondary and tertiary markets. In addition to growth via acquisition, internal growth substantially exceeded industry average growth rate of 13% in 1969.

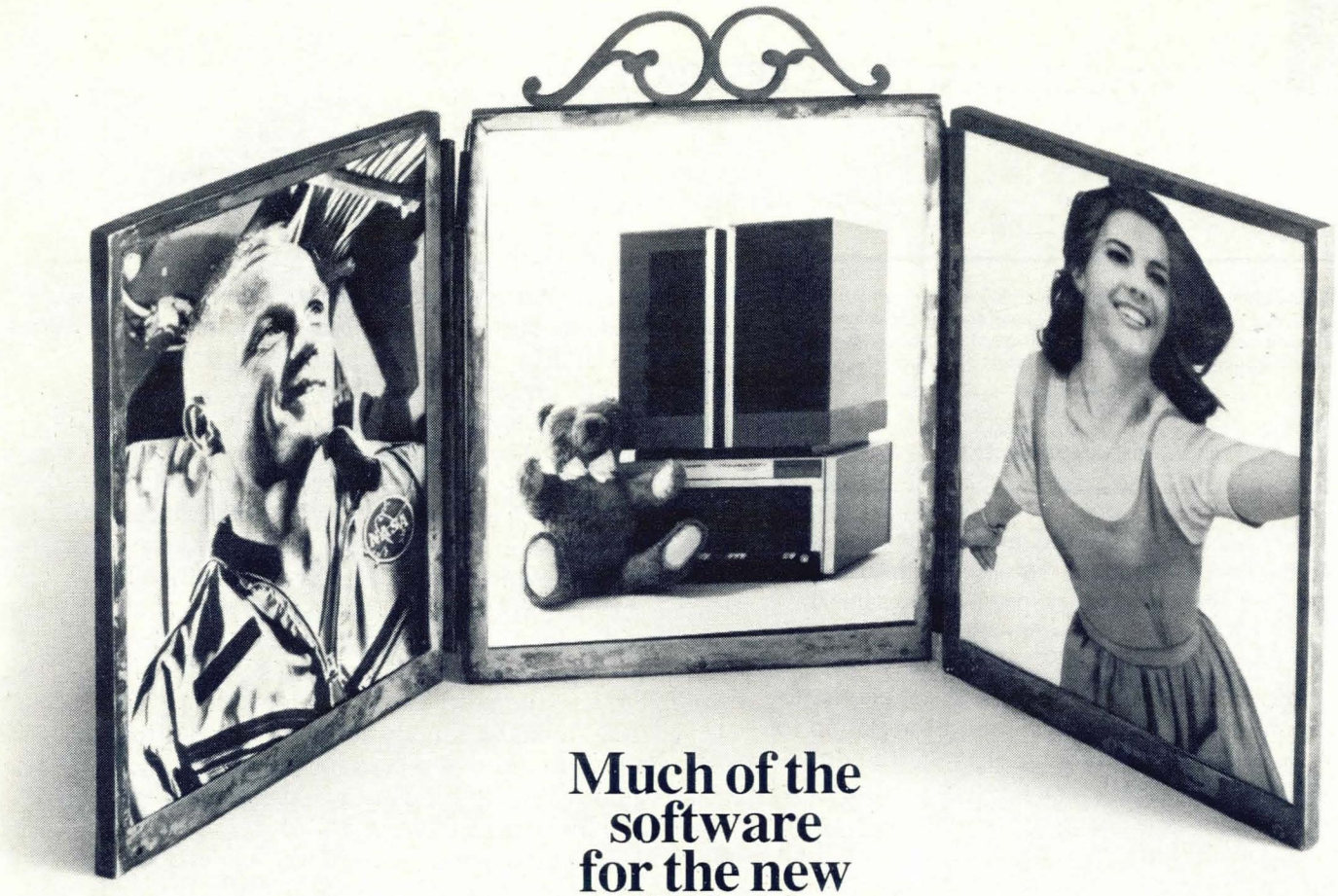
FINANCIAL SUMMARY: The following statement of earnings depicts consolidated results of UDC's operations for two years ended December 31, 1970. Also shown are comparative interim statements for the current and prior reporting periods.

YEAR ENDED DECEMBER 31

Year	Revenues	Net Income (Loss)	Net Income Per Share (Loss)
1969	$2,132,175*	($225,576)	(0.26)
1968	1,391,807*	68,012	.09
Six months (ended 6/30/70)	1,386,423	67,891	.08
Six months (ended 6/30/69)**	865,347	(40,180)	(.05)

*Exclusive of $795,488 (1969) and $921,031 (1968) from company sold in 1969.

**Figures for the six months ended 6/30/69 have been adjusted to eliminate loss from subsidiary sold on 12/31/69.



Much of the software for the new PDP-8/e is 9000 computers old

It was 1962. John Glenn became the first U.S. astronaut to orbit the earth. *West Side Story* won an Oscar as best picture of the year. Hemlines reached almost to the knee and were still rising.

That's when software for the PDP-8/e was begun.

Two years later, we introduced the world's first minicomputer, the original PDP-8 with teddy bear. Since then, we have created, extended, and polished the software that works on all 9000 PDP-8 family computers—computers that control blast furnaces, monitor nuclear reactors, analyze electrocardiograms, perform all kinds of process and machine control functions. Software for the PDP-8/e really works, and much of it has been working for a long time. On the other hand, much of it is brand new. DIBOL—DIGITAL's new business oriented software. PS-8, the new device independent programming system. And lots more. All together, old and new, there's an awful lot of it.

The PDP-8/e is based on an entirely new concept in minicomputer architecture, completely flexible, completely expandable.. Everything, including the CPU, just plugs into the OMNIBUS™ . You buy only what you need, expand later if you want. And you can start at less than $5000 for the basic 4K machine.

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Digital Equipment Corporation
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CIRCLE NO. 21 ON INQUIRY CARD

COMMUNICATIONS CLINIC

DATA ACCESS OR DATA RESTRICTION

Communications Clinic is a regular monthly column written by the staff of **Berglund Associates, Inc.**, consultants in telecommunications. Readers are invited to submit questions on any aspect of communications or suggestions for future Clinics to:

Communications Clinic
c/o Berglund Associates, Inc.
1060 Kings Highway North
Cherry Hill, New Jersey 08034

As we blew the dust off the interconnection file, we realized – disturbingly so – that almost two and one-half years have elapsed since the dramatic decisions on interconnection were announced. In seeking a good lead for a Clinic on that subject, the gestation period of elephants came to mind. Regrettably, we found the period to be 21 months, a period long past in the interconnection question. We can't resist pointing out, however, that it was 21 months from the Carterfone decision in June of 1968, until the last Bell jurisdiction, Michigan adopted the foreign attachment language in its tariffs in March of 1970. The only other elephant statistic noted was simply too depressing to relate to interconnection: their average life expectancy is 60 years.

Excepting our history of the Carterfone case (MODERN DATA, December 1968) and a report on the DAA (MODERN DATA, April 1969), we have refrained from commenting on interconnection. This has been because of its complexity and its leverage. By leverage we mean that even a slight swing in one direction on interconnection policy could have disastrous effects on network reliability, while a swing in the opposite direction could materially retard the contribution of data communications to our socio-economic system. Where such swings are compounded by being based on complex technical and economic factors, decisions should be made slowly. And the emotional overlay to interconnection requires compulsively careful analysis before such decision making.

Notwithstanding a reluctance to add to the sound and fury, two recent events have moved us to leave the safety of "no opinion" and present our own bias on the question. The first event was our receipt of a paper entitled "Data Access or Data Restriction" by Charles Johnson, President of General DataComm Industries. Mr. Johnson is qualified as an expert witness by virtue of his role as an independent supplier of data communications products and by his prior experience in telephone system engineering, both within and outside of the Bell System. The paper is an extremely articulate and forceful development of Johnson's position that the Bell System tariff provisions on interconnection are "data restriction, not data access." In particular, Johnson deals with the economics of competition, which we will discuss below. The force of his economic analysis, however, didn't really hit home until the second event. In a recent consulting assignment for a time-sharing service supplier, we studied the use of independently supplied 103 equivalent modems. The most desirable offering we found was a package of eight modems in a small cabinet, which, on a three-year lease-purchase basis, priced out at $11.41 per month per line. This would have reduced the client's operating expense, even as compared with the Bell 113B (anticipated at $12-14 per month with first quarter '71 availability). However, with the independently supplied modems, we had to plan on the type CBT automatic DAA at $4.25 per month, resulting in: (1) no cost saving to the client, and (2) a substantial amount of space tied up just in DAAs.

This offends our sense of what is right. Let us now turn to the Johnson paper wherein he develops this point, and we quote:

II. POTENTIAL EXISTS FOR UNFAIR COMPETITION PRACTICES

Effective Bell System tariffs contain mandatory requirements that interconnection be via a Bell System-provided dataset or, in those cases where a customer-provided dataset is to be used, via a Bell System-provided Data Access Arrangement. No DAA is required by the tariff when a Bell dataset is used. Therefore, within Bell System service areas, they presently participate in each data service to the extent of either a dataset or a DAA, and in *every* case, in the provision of the telephone line itself. The telephone line and DAA devices can *only* be provided by the Bell System, a situation characterized by an absence of competition. On the other hand, the Bell System is presently allowed to compete with independent dataset manufacturers concerning the datasets themselves.

Cost/Rate Consideration

Since they must compete for this business, it is interesting to compare the development of rates for a dataset in contrast to that for a Data Access Arrangement.

WHERE BELL HAS	COMPETITION 103A Data Set	and 113A Data Set	NO COMPETITION DAA (F58118)
Approximate Western Elec. selling price to Bell Assoc. Co.	$380.00	$170.00	$32.00
Effective or AT&T recommended monthly rate	25.00	10.00	4.00[1]
Annual Rate as a percentage of Western Electric selling price	78.8%	70.6%	150.0%

When it is noted that the F58118 DAA is a minimum feature unit, which does not contain remote test facilities or a telephone set and, compared to a dataset, has a longer life (less susceptibility to obsolescence) and lower installation and maintenance costs, it is seen that the proposed $4 rate is improperly based, exorbitant, and has the effect of influencing data users to use Bell datasets instead of those available from independent manufacturers. If the automatic DAA rate is computed on a basis consistent with that for the datasets, its monthly rate would be around $1.50, which is still excessive for a device to provide network protection. This is further compounded by the fact that the installation charges for the DAAs are in many cases the same as, or exceed, those for the much more complex datasets.

---

[1]This charge runs as high as $6.75 per month in some states, representing an annual rate to selling price percentage of 253%; the F57951 Manual DAA percentages range from 108% to 300%.

The fact is that the independent dataset supplier must concern himself with not only the price for his dataset, but the DAA rate as well. Presumably he can build his sets to meet Bell offerings in the marketplace. However, he must also justify to his customers a further monthly cost for the DAA (an exercise not required of Bell) which is not subject to competitive pressure. Finally, it appears that Bell is using a different pricing strategy on its non-competitive offering which, based on Johnson's data, is anticompetitive and unfair to independent suppliers. We certainly stand for motherhood and network protection. We find abominable, however, a high markup on the requirement for entry of an independent supplier to a market **where no natural monopoly can be remotely justified.**

The interconnection question is still under review by the FCC and its Common Carrier Bureau. It will be recalled that the Commission simply allowed the tariff revisions to go into effect (January 1, 1969), neither approving nor disapproving of them. The subsequent almost two-year period has been expended in:

- A series of informal conferences on tariff language and provisions between interested parties under the aegis of the Common Carrier Bureau.

- A study of technical issues conducted by a select committee under the direction of the National Academy of Sciences, the committee membership comprising professionals from common carriers, suppliers of time-sharing service, equipment manufacturers, consultants, and engineers from university research and laboratory activities.

- A study of the NAS report and the general subject of interconnection, conducted by Dittberner Associates and authorized by the Commission.

- Filing of comments on the NAS report by interested parties, completed by September 1, 1970.

Of most significance were the principal findings and recommendations of the NAS report. We quote from the report's letter of transmittal:

The Board hereby commends to you these principal technical findings of the study:

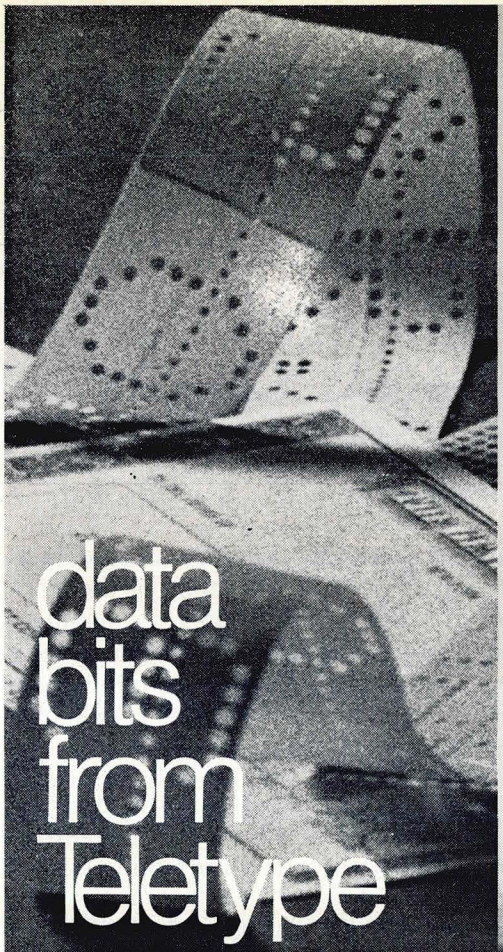
1. Uncontrolled interconnection to the common carrier network as it now exists would be harmful;

2. The requirements of the tariff criteria limiting characteristics of interconnected lines are technically based and in accord with the operational limits of the common carrier network as it now exists;

3. The nature of potential harm, criteria for protection against such harm, and the performance of various components of the telephone system can be specified explicitly enough to be understood and acted upon properly by people with normal technical competencies.

Having found that harm of various kinds can occur and that technical limitations on interconnection are therefore necessary, the Panel studied protective measures. On the technical basis of the third set of findings, the study concluded that the following two approaches—used either alone or in parallel in such proportions as non-technical factors might determine—can supply the required degrees of protection for the network, including network control signaling:

1. Protective arrangements as required by the tariffs;



data bits from Teletype

payout time cut from week to 24 hours

A large insurance company with over twenty benefit paying offices across the country has slashed payment authorization time from seven days to 24 hours or less using Teletype® equipment and a computer.

Local offices put benefit application data on punched paper tape. The tape is placed in a Teletype terminal's tape reader at the end of each day. Then the home office computer automatically polls each unattended terminal during the night. The entire data collection process runs about 1½ hours.

The computer sorts incoming data by policy number and produces all of the significant facts required to make accurate payment decisions. This data is transmitted to the local offices where it is reproduced in easy-to-use page copy form by Teletype automatic send-receive sets. Helping the insurance company provide the type of payment service policyholders really appreciate.

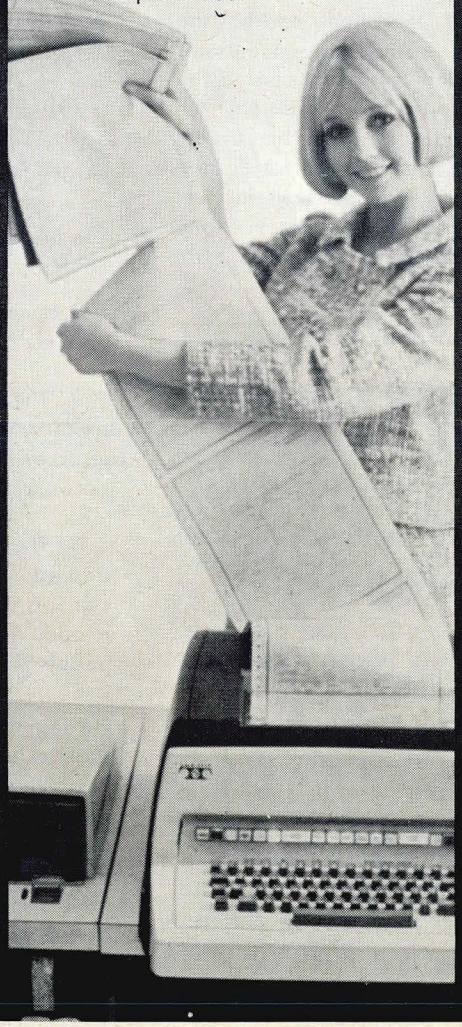
finicky forms filled on-line

The model 37 has a large number of interesting data communication capabilities. One that means business to many people is its ability to produce multiple copy business forms on-line.

This heavy-duty terminal has: horizontal and vertical tab stops that can be set on-line by operator or any remote terminal using ASCII code. Full and half-line space (forward or reverse). Optional pin feed platen and form feed out control. Types in upper and lower case. Sends and receives data at 150 wpm. It really makes form filling operations fly fast.

With the model 37 it is even possible to add up to 32 special characters to the normal compliment of letters, numerals, symbols and punctuation marks found in its typebox.

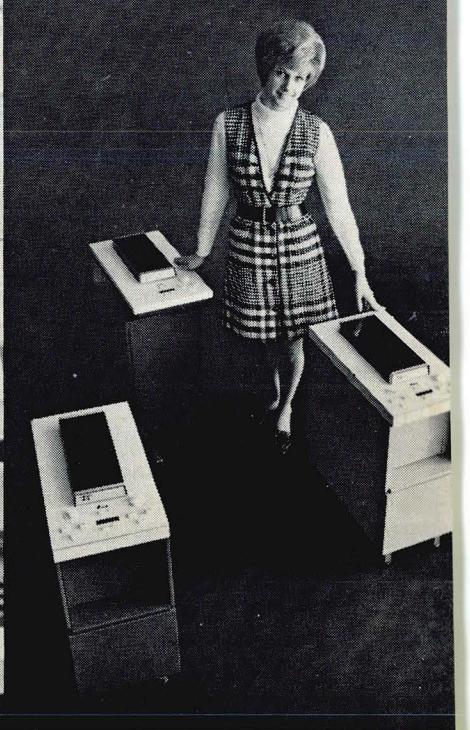
It's a great time-sharing tool, too. The first terminal that enables you to take full advantage of ASCII capabilities.



new magnetic tape data terminals

Visualize 150,000 characters of information tucked neatly into a compact 3″ by 3″ by 1″ tape cartridge. Making data easier to use, move, handle and store. A reusable tape that brings new economy to communication system operations. Teletype magnetic tape data terminals give you these important benefits, plus on-line speed capabilities of up to 2400 characters per minute.

These magnetic tape terminals are compatible with Teletype model 33, model 35, model 37 and Inktronic KSR equipment. Will send and receive data at both high and low speed. Tape recording, loading, message search, editing and other related functions are extremely simple.



fast data flow keeps cement on the go...

One of the nation's largest cement and building materials producers uses Teletype equipment and a computer to help keep its vast marketing complex under control.

Company manufacturing facilities, warehouses and sales offices span from Hawaii to Florida. Teletype tape-to-tape terminals and automatic send-receive sets are used to move order, billing, and shipping data, as well as administrative information. Teletype terminals are also used as a management tool to generate financial, statistical and marketing data using a time-sharing computer.

Taped order information sent to manufacturing and distribution centers is received by Teletype equipment that produce it on multiple copy business forms. Making possible far faster customer service and improving operational efficiency.

recommended reading

Teletype has a number of brochures on equipment, applications, and case history data. A short description of what is available is contained in: "How to get answers to your questions about Teletype equipment." Write for your copy.

Teletype data communication equipment is available in send-receive capabilities of up to 2400 words per minute. Included are hard-copy, magnetic-tape and paper-tape terminals, error control devices, options and accessory equipment to fit most data communication system requirements. For information, write:

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CIRCLE NO. 22 ON INQUIRY CARD

2. A properly authorized program of standardization and properly enforced certification of equipment, installation, and maintenance.

Analysis of potential harm and protection capabilities revealed no technical reasons why innovation would be significantly restricted by either of the two approaches alone or in combination. The choice clearly impinges on economic and social problems and on questions of industrial structure which are beyond the purview of the study.

Among the Dittberner findings, the significant were as follows.

- Equipment with network protective capabilities is required to provide an acceptable level of protection. However, network protective "devices," *per se*, are not required.

- Common carriers should not have an exclusive right to provide equipment with network protective capabilities to the end-user.

- Although the NAS program of standardization and certification of equipment, installation, and maintenance is technically sound, its implementation feasibility is limited by such non-technical factors as manpower and funding availability.

They recommend that interconnection should be permitted without common carrier access arrangements, provided that foreign attachments meet network protection standards and are installed and maintained by an FCC-certified installation/maintenance contractor.

As of this writing – November 1970 – the Commission and staff are presumably mulling all of the information submitted. We look forward to some policy/action position in the near future. It is apparent to us that some improvement is required in favor of a more liberal interconnection policy. Two and one-half years of little progress is a de-facto postponement of the importance of the FCC's original decision. This is attested to by the fact that as of July 1970, AT&T reported 1,658 DAAs installed. This amounts to about 1% of switched network data sets – a far cry from the much heralded new era envisioned in 1968.

A NEW PROPOSAL

Our own view is that there must be network protection, in terms of power-voltage-frequency inputs, and in terms of reliability of network control signalling. We do not believe these functions should be provided under a supplier's self-certification system because there is too great a potential for damage to a system which it behooves us all to see operating near-perfectly. On the other hand, neither do we favor the common carriers' exploiting the need for network protection. It does seem to us, however, that the interests of all could be served by the following arrangement.

We propose that the common carriers in concert with EIA undertake design of standard modules for network protection and network signaling in digital communication applications. These modules would be designed to connect to exchange circuits on one side, and to foreign attachment circuitry on the other. The attachment interface should be such as to place all functional load on the attachment, leaving module circuitry only for network protection and network control supervision. This would preclude the costs of redundancy.

The modules would be designed to plug into a standard receptacle on the foreign attachment. This would eliminate the need for extra space in installing DAAs. This would also permit a common carrier serviceman to insert quickly his own modules if he suspects problems in the access arrangement. Alternatively, an appropriate test set could be plugged into this receptacle for division-of-responsibility testing.

These modules should be manufactured by historical suppliers approved by the common carriers, such as Western Electric or Automatic Electric. They should then be sold openly in the market, **at prices based on return on investment to manufacture.**

We believe this proposal would meet all needs, and also aid development of data communications in general. Manufacture by a carrier-controlled entity assures the quality and reliability required for network protection. Elimination of redundancies and outright sales based on pricing on return on investment should remove the common carriers' present advantage in being able to supply data sets without access arrangements. As a refinement on this, perhaps the same modules could be required in common carrier datasets. Outright sale would also resolve the question of rate variances between intra-state tariffs. Regulation of sale price would be substantially less complex to implement and administer than would be the various certification programs being discussed. Production by one or two manufacturers should yield economies of scale not available should each independent supplier manufacture for his own needs. Finally, standard plug-in modules would enable rapid solution of division-of-maintenance problems.

We believe this approach would take no longer to implement than presently considered approaches of independent certification. Yet we believe it would be eminently more practical to administer, and more clearly of greater import to industry growth. ▲

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CIRCLE NO. 23 ON INQUIRY CARD

LAWRENCE A. FEIDELMAN, Vice Pres. • Information Spectrum Inc., Cherry Hill, N.J.

SOURCE DATA AUTOMATION

POINT-OF-SALE DATA COLLECTION SYSTEMS

Point-of-Sale (POS) Data Collection relates to recording all information needed to transact a sale at time of purchase, i.e., item identification, price, customer identification, etc. The two basic POS activities are (1) writing-up or recording the sale (2) checking customers' credit for a non-cash sale.

Since customers are awaiting their purchase, these activities must be performed quickly and accurately. In addition, with the advent of the computer, POS information must also be placed onto a computer-readable medium.

The Point-of-Sale data capture problem represents an ideal application for Source Data Automation techniques since data recording can be automated at the initial point of data generation. After many years of stagnation, the retail merchandising field is being bombarded by manufacturers, resulting in a new generation of Point-of-Sale systems.

PRESENT POINT-OF-SALE SYSTEMS

Presently, most POS automation is implemented by utilizing several different techniques, each for a different POS activity. Sales recording is accomplished at the cash register for a cash sale and by hand for a credit sale. Numerous cash registers exist which simultaneously record data on paper tape or print data in OCR-readable font on journal tapes. Furthermore, department stores are experimenting with automating credit sales by using OCR-readable credit cards for customers' identification and using handprint OCR machines for reading sales data. Checking on a customer's credit involves the use of credit card readers and push-button telephones in some cases, and voice conversation in most. Finally, prepunched tags attached to the merchandise and removed at the time of sale are used for determining the store inventory. These tags, however, have the disadvantage of not being alterable when the item price is changed.

The implementation of these equipments has not resolved the major POS problems of (1) data entry errors caused by the salesperson, (2) excessive time spent on credit verification, (3) excessive time spent on recording the sale, (4) use of numerous different equipments from different manufacturers, (5) duplication of data recording and, (6) time delay (in days) between sale recording and customer billing.

NEW POINT-OF-SALE SYSTEMS

The integration of all POS functions into one system and the elimination of the above problems are the basic objectives of the new Point-of-Sale data collection equipments. These equipments are essentially self-contained electronic calculators, most of which can also be used as computer terminals. The POS data collection device performs all necessary calculations on the entered data, i.e., tax, discounts, and sum. Data can be entered via the keyboard or directly from the merchandise tags. The latter technique eliminates the error-prone manual input problem. Also, the equipment checks customer credit on-line, places data in the customers' account, and records information for inventory control. The proper entry sequence is indicated to the salesperson by a sequence of keyboard lights. A display permits visual verification. The resultant data is recorded in machine language onto a computer-readable medium.

The recently announced NCR 280 retail merchandising system (Fig. 1) and Friden's presently operational Modular Data Transaction System

Mr. Feidelman is a regular contributor to Source Data Automation.

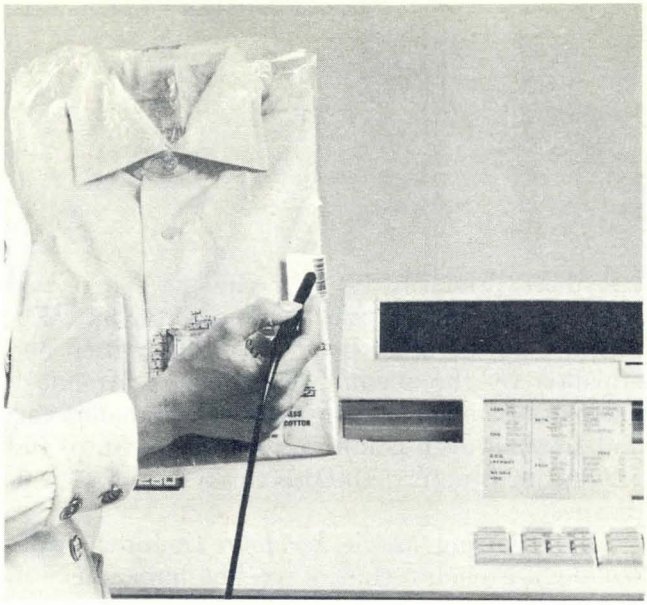

Fig. 1 NCR 280 RETAIL SYSTEM TERMINAL. Hand-held "wand," the size of a ballpoint pen, reads merchandise price tags, credit cards, and salesperson identification badges as part of new system introduced by the National Cash Register Co. Data collected at the point of sale is subsequently processed by computer for customer billing, inventory control, and various management reports.

(MDTS) are representative of the SDA approach towards a centralized computer system with remote terminals. The system design modularity permits the terminals to be employed off-line, with data being recorded onto magnetic tape, as well as on-line. Such self-contained terminals are a boon to the smaller retailer who can't afford a larger computer system, but can easily use a terminal as an input to a remotely-located service bureau.

Another innovative system aimed at capturing data with as little manual entry as possible uses a special keyboard designed by Information Technology, Inc. for the fast food industry. Instead of entering prices, the salesperson enters the name and quantity of items sold (2 hamburgers, 3 coffees, etc.). The POS terminal, using stored price data, then performs all necessary calculations. This technique could be extended to a department store by previously storing the price for each item and only entering the item code into the system (preferably by an optical reader), thereby eliminating errors caused by price changes.

Prices for these systems presently range from $3,000 to $5,000 for a single POS data collection device, and $25,000 to $1 million for an entire system. With present trends in LSI technology, these prices should be substantially reduced by 1975.

In summary, then, Point-Of-Sale data collection is coming out of its infancy with the advent of modularized integrated systems. Such systems will permit both the small and large retailer to share in the use of this product from both economic and operational viewpoints. ▲

RICHARD PETTERSEN • European Editor

EUROPEAN REPORT

THROUGH EUROPEAN EYES

Among the many differences between American and European industry, perhaps none is more striking than the general attitudes toward security. Competition is not so cut-throat in Europe and the "Cold War" has never been the object of as much political manoeuvering and strident publicity as in America, with the result that the European firm is not ready to see an enemy spy – company or international – skulking behind every filing cabinet.

Americans are shocked to enter a European plant where the guard at the gate considers himself there primarily to help you get where you want to go, rather than to keep you out. Europeans, on the other hand, are both amused and appalled by the seeming paranoia of American firms in not only keeping everything under lock and key, but even going so far as to pry into, and attempt to structure, the private lives of their employees.

The following article by Jean Dandrezy from *Hebdo*, a French technical weekly, humorously illustrates the point:

MUST WE HAVE LOYALTY OATHS?

A True Story

A young programmer of our acquaintance had been with the data processing department of an electrical controls firm for four years and was awaiting, with some impatience, a promotion that never seemed to arrive. He mentioned his problem to a friend who proposed to put him in touch with the Paris branch of a large American company, where he could reasonably expect to earn 30% to 40% more. For the sake of convenience, let us call that company Quick Programs.

Our young programmer applied for an interview with the friend of his friend, who held an "important position" with Quick Programs. He was received by a man in his forties, typical American businessman type, who asked him a few questions about his studies and his present job.

The conversation lasted no more than 20 minutes. Our candidate returned home feeling that he had not made much of an impression. Great was his surprise when, two weeks later, he received an invitation to present himself at the headquarters of Quick Programs, where two psychologists grilled him with questions. ***Had he ever belonged to a leftist political party? Which newspapers did he read? Was he interested in the foreign and domestic policies of the government? Did he sometimes long to be whipped? Did he often dream of walking naked through the streets?***

When the interrogation finally ended, our candidate was presented with a form which he was requested to fill out and return to Quick Programs. The form began with the following statement, in both French and English: "I swear to devote all of my time, all of my abilities, and all my energy exclusively to the service of the Company". In capitals. ***A true loyalty oath!***

Our programmer tore up the form, resigned from the company where he was working, and moved to Provence to devote himself to his preferred vocation of astronomy. And with no increase in salary. ▲

CAS/CART PROFILE ADDITIONS

Modern Data regrets that the following manufacturers were overlooked during the compilation of the Cassette/Cartridge Technology Profile in our August issue.

CAS/CART TRANSPORTS

Genisco Computer Products
18435 Susana Road
Compton, Cal. 90221

CAS/CART TRANSPORTS

Teletype Corp.
5555 Touhy Avenue
Skokie, Ill. 60076

CASSETTES

K/Tronic Inc.
10601 Saratoga - Sunnyvale Road
Cupertino, Cal. 95014

With $250,000 a race riding on his system, this OEM places his bets on an HP tape drive.

American Totalisator has just computerized its world-famous Tote Board. So odds and payoffs can be posted instantly. And with indisputable accuracy.

Unless the computer "crashes."

In which case, you've got a mob of outraged race fans to contend with. So the computer is backed up with HP's 7970 Digital Magnetic Tape Recorder. If there is a "crash," the 7970 can be relied on to get the numbers back on the board in minimum elapsed time.

Reliability makes the 7970 a money winner for American Totalisator. Its exclusive HP features assure trouble-free operation from 10 to 37.5 ips.

And to make sure the 7970 stays in the winner's circle, there are 141 Hewlett-Packard sales and service offices around the world to serve you and your customers. If a 7970 should need work, simple plug-in service cards permit repairs on-site with minimum down time.

American Totalisator chose the HP 7970 Digital Magnetic Tape Recorder for reliability. If you want a sure thing, just call your local HP field engineer. Or write to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

CIRCLE NO. 25 ON INQUIRY CARD

42003

HEWLETT hp PACKARD

MAGNETIC RECORDERS

THOMAS DeMARCO, Vice Pres. • Mandate Systems, Inc., New York, N.Y.

THE SYSTEMS SCENE

SOFTWARE FOR SCHOOLS

Performance contracting refers to the letting of contracts to private education companies to conduct specified courses in the public schools. In most cases, compensation is made according to actual results achieved by the students.

Emphasis is on a **systems** approach to education. Contractors, being profit-oriented, are necessarily dedicated to the development of new and effective methods of teaching. The companies are much more inclined than local schools to implement such things as teacher incentives, C.A.I., programmed learning systems, and control group testing of new ideas.

Is this good? It must be. Teachers' unions are livid. The National Education Association has attacked the concept in Congress and threatened to take the issue to court. The American Federation of Teachers says the idea is dehumanizing. The United Federation of Teachers has sought an injunction against performance contracting and called the program a new Nixon plot. The *New York Times*, in an editorial, said that such performance-oriented teaching was "percentomania."

Why are all these nice people so upset? Performance contracting has a number of characteristics that are particularly disturbing to some of the groups mentioned. It is new, not very expensive, and it just might work. In addition, it implies that educators ought to be judged on the effectiveness of their work.

Unorthodox methods applied by a few of the contractors have aroused considerable ire. There have been incidents of children receiving candy or trading stamps or extra free time as rewards for doing well. What some unprincipled people won't stoop to when teaching children to read!

Title I of the Elementary and Secondary Education Act of 1965 provides $1.5 billion in fiscal 1971 for extra education for the disadvantaged. The Administration is concerned that little of this money is being used effectively. The OEO and Office of Education have started experiments in performance contracting to attempt to change this situation. The first project was started in Texarkana, Ark. last winter with a contract awarded to Dorsett Educational Systems. All current experiments are aimed at groups of children with substantial reading deficiencies. That statement is not enough: their present capabilities range from poor down to heartbreaking. In many of these cases, the present educational system has failed abjectly.

This is not an indictment of the teachers involved. Their task has too often been complicated by children who were hungry or terrorized or products of an emotionally disturbing home life. A new approach is called for and performance contracting at least is new. Under the circumstances, the opposition that has been mounted against even testing this new idea appears unconscionable.

Results of the Texarkana project were, on the whole, extremely rewarding. Average reading levels of the most successful group of students were increased by 2.2 grade levels after 60 hours of special instruction. Later results were clouded by charges that the curriculum had been too much oriented toward the tests. These charges have pointed out that more sophisticated accountability standards must be developed to make performance contracting effective. All things considered, the principals, teachers, and staff of the local school board were highly enthused and now wish to "turnkey" the system this fall. (Most performance contracting involves only one year of actual implementation by the company, followed by turnover of the systems to the local schools.)

Contracts have been let by 18 school districts in 16 states as part of the OEO program. Six companies are participating: Alpha Learning Systems, Learning Foundations, Plan Education Centers, Singer Graflex, Westinghouse Learning and Quality Educational Development. Education Turnkey Systems provides management support services to the whole project.

I talked to Charles Blashke of Education Turnkey Systems. His company is also building a data base of performance contracting companies. So far, some one hundred companies are actively soliciting contracts or have expressed the intention of doing so. If this year's experiments continue to be successful, ETS will provide a selection service to help school boards contact contractors to solve their particular problems.

Many of the companies are made up of a blend of education and ex-computer systems people. It is this influx of systems people and companies into the staid area of education which is particularly exciting. RCA has already moved into the field. Some of the other strong systems houses like IBM, Informatics, or PMI could be enticed to follow.

Hell knows no fury like a systems firm in search of more profitability. If that kind of energy and excellence can be channeled towards educating the disadvantaged we all stand to win. ▲

Mr. DeMarco is a regular contributor to The Systems Scene

It's that simple.

No special training is needed to switch operators from an electric typewriter to our new "n" key rollover solid state keyboard.

That's because all electric typewriters have "n" key rollover. So... same touch. Same feel. Same spacing. Same operator habits.

And a lot less chance of mistakes. (Tests indicate our new keyboard reduces operator error by as much as 30% over two-key rollover keyboards.)

Our "n" key rollover is also more reliable. The pulse output to our MOS is part of the solid state chip within the key, rather than a pulse network of discrete components. And fewer parts mean fewer things that can go wrong.

For more information, call or write your MICRO SWITCH Branch Office. It's that simple.

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KEN FALOR, Dir. Mktg. Services • Cullinane Corp., Boston, Mass.

SOFTWARE FORUM

MIS FOLKLORE—AN OPINION

MIS is a folk myth. It fits all the requirements. It is legend, undefinable, exciting, vague, perpetually innovative, and revolutionary. And yet, real in some (no one can know what) respects. It can mean anything anyone wants it to mean. It is the greatest idea invented since the computer as a "brain" in the early days of computer folklore. And most of all, it is amazing that businessmen, those pragmatic paragons of cost consciousness, are spending millions of dollars trying to capture its mystique.

DEFINITIONITIS

There is currently a wave of activity in defining what is meant by MIS. The effect has largely been the organizing of confusion. Most of the problems result from using buzz words like MIS instead of plain English.

Consider how much information you obtain from hearing laymen say that they "have a computer at their place." The professional's immediate reaction is confusion and doubt. We know only that it may be a maxi, midi, mini, mechanical, electrical, or even a complex thermostat-controlled device.

So what is MIS? We don't know. But we doubt you have one because, by folk definition, a real MIS is always something at least one step beyond what is currently available. Seriously though, even if we can't define what an MIS is, we can relate it to the more generally understood concept of a common data base system.

COMMON DATA BASE SYSTEMS

A common data base system is one in which data from any file is referred to related data in all other files. Along with this structured (rather, multistructured hierarchal) data base itself, with its links, chains, rings, and what-not, comes a couple of other things.

The first is a large mass of data — in fact, all you have.

The second is telecommunications facilities: the black boxes on executives' desks, or at least, on customer service clerks' desks (one of the most appropriate places for them).

A final item that goes with the monster data base is a management system or software "keeper" for the monster. This is so the ordinary programmer won't ever have to come face to face with the monster. The programmer tells the data base management system what data he wants from it, and the keeper has the job of going in and getting it from the monster.

A data base management system usually accommodates existing Cobol, Bal, etc. programs with simplified data handling. It also permits changes in the data base structure without affecting the application programs. The data base management system is what MIS really means to many people that have lately been exposed to "what's happening."

We personally believe that the move towards the complex common data base management system is a good direction to go, and that it will be an interesting place to get to, someday. In a few cases such systems are here today. Too often, though, the concept is misapplied. We feel that for most businesses dealing with more or less standard applications (not counting model building), it usually isn't economically or otherwise feasible to "go all the way" with present technology. Some of the innovations in mass, associative, and cheap high-speed bulk memory devices now in the laboratory must be brought to the production line before the monster's upkeep can be controlled, maintained, and made really practical for 99% of the business world.

In the meantime, the core of truly professional business EDP work lies in effectively utilizing proven and practical resources to generate, acquire, and upgrade essential systems and efficiently service user departments. And in keeping aware of new data base management techniques as they **economically** prove themselves. ▲

Mr. Falor is a regular contributor to Software Forum.

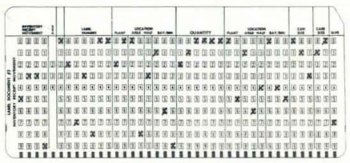
You say you're looking for a more efficient way to enter inventory source data?

The machine staring up at you is our MDR optical mark reader.

It reads ordinary pencil marks (in Hollerith spacing, on cards or pages). And that makes it a natural for inventory control—or, for that matter, many another source-data entry task. Everybody can operate a pencil.

So, with the MDR, you can collect computer-usable data right at the moment and place of origin.

Consider the happy experience of a very large canning company confronted with some huge inventory and payroll problems.



The company has five plants which collectively process about 18,000,000 cases of canned goods a year.

The work is seasonal. The work force is transient. And the market fluctuates fantastically.

Current inventory data is crucial information. On any given day, management has to know exactly what commodities, and quantities of each, are being picked, processed, and put into the warehouse.

The payroll for day workers has to be updated continuously, too. In peak periods, there well may be ten thousand payroll transactions a day.

Our MDR optical mark readers are located in each of the five plants. The MDRs batch the inventory and payroll data into Motorola magnetic tape recorders at the company's computer central. Input to the computer is direct from the mag tape.

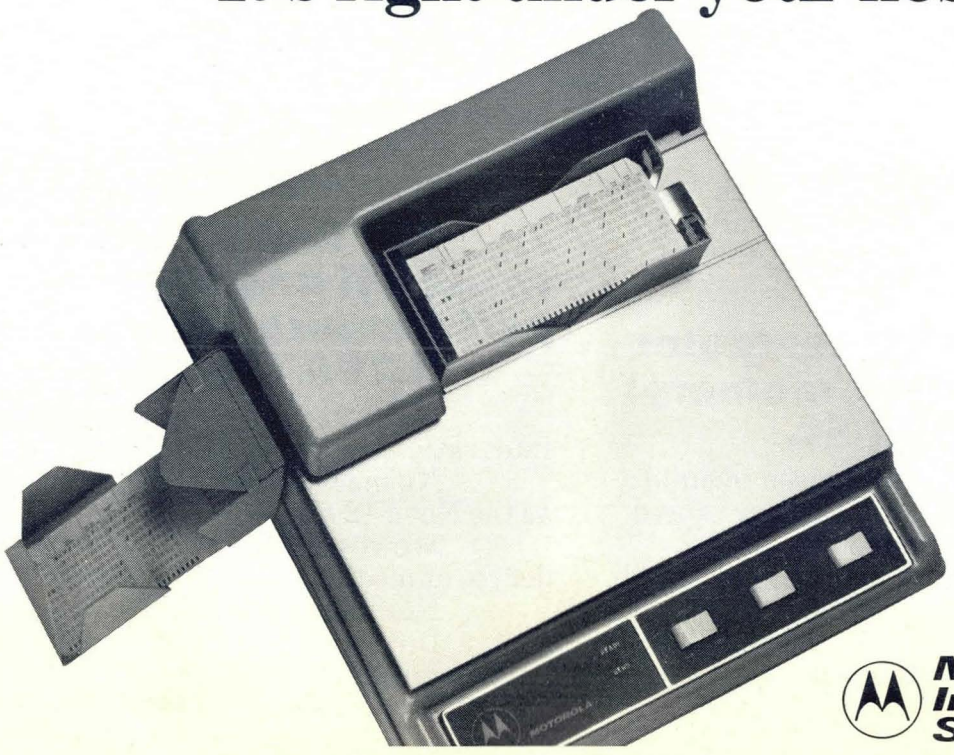
Data flow is fast and efficient. Faster than keypunch, certainly. Or even key-to-tape. Because there's no time lost in conversion at a keyboard. Data is formatted and put into machine language at the moment it's originally recorded.

Regular clerical personnel are doing the job.

With ordinary ten-cent pencils.

Write us for a copy of our MDR brochure. It's a concise source book of ideas on source-data automation. Motorola Instrumentation and Control Inc., a Subsidiary of Motorola Inc., P.O. Box 5409, Phoenix, Arizona 85010.

It's right under your nose.



4834

MOTOROLA Information Systems

CIRCLE NO. 27 ON INQUIRY CARD

HOW WE'RE THE MINI COM

We're winning by introducing three new Nova-line 16-bit mini computers that go faster and cost less than the competition.

We're winning by being smart.

By looking ahead at what mini computers are going to be used for.

By designing new computers to take advantage of new technologies.

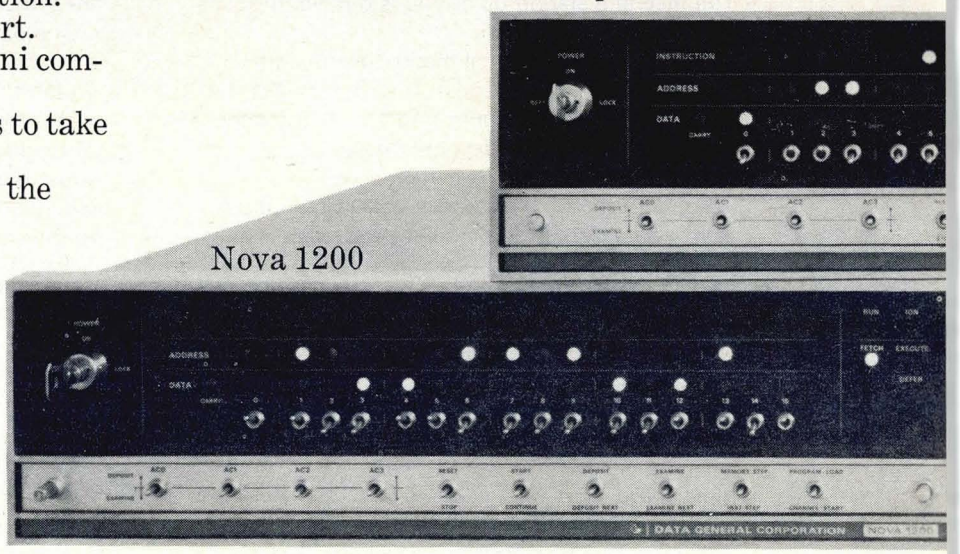
By staying one step ahead of the competition.

We've been winning the battles consistently.

In just 2½ short years we've introduced a complete line of mini computers, software and peripherals, and we've grown from a total newcomer to one of the big three.

Our latest victory can best be described by describing our three new machines:

Supernova SC



SUPERNOVA SC:

The first mini computer with a high-speed all monolithic memory, making it the fastest mini computer in the world.

NOVA 1200:

The first mini computer to take advantage of large-and medium-scale integration, making it very fast (1200 nanosecond cycle time), most reliable, and considerably less expensive than any other mini computer at its performance level.

NOVA 800:

A new machine that offers even more speed and performance than the Nova 1200 for the guy who needs it. At a price he can afford.

The first mini computer with all monolithic memory: SUPERNOVA SC.

There's only one real reason to build a machine around a monolithic memory: speed.

Not just cycle-time speed.

Real speed, that can only be measured in terms of instruction execution.

The Supernova SC can execute arithmetic and logical instructions in 300 nanoseconds.

In a single memory cycle.

That's because we built the Supernova SC processor around its monolithic memory.

It overlaps the instruction execution cycle with the fetch of the next instruction.

Which takes advantage of the real speed break available with a monolithic memory.

As we said, we used a monolithic memory in order to take advantage of it.

Not just so we could say we had it.

Price: $11,900 *

The first mini computer to use LSI and MSI to gain performance and economy: NOVA 1200.

Other machines use large-scale integration.

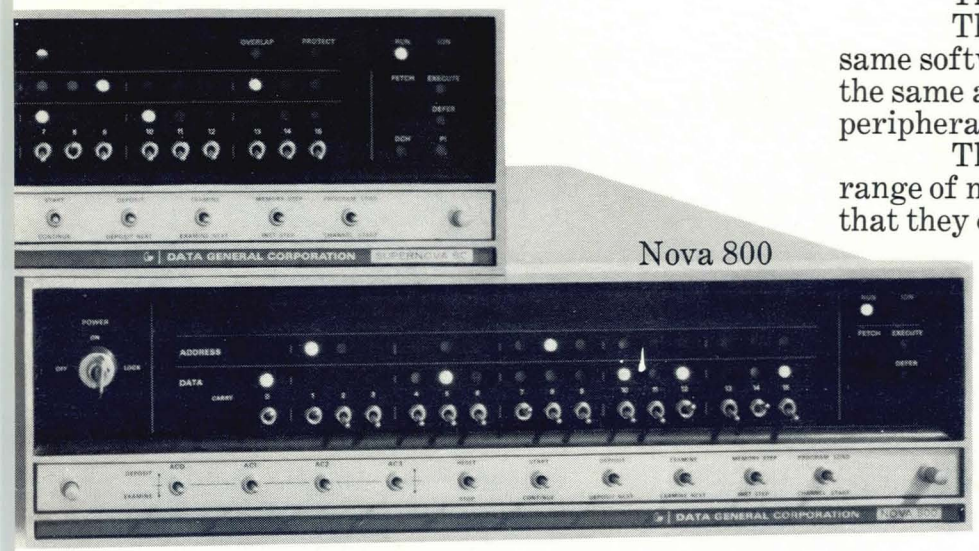
No machine has used it as effectively as the Nova 1200.

We've combined LSI with a high degree of medium-scale integration.

Not just so we could say we did.

But so we could drastically lower the parts count, increase reliability, lower cost, and still make the Nova 1200 2½ to 3 times

WINNING PUTER WAR.



Nova 800

faster than its predecessor, the Nova.

So we could offer a mini computer that ranks, in terms of performance, at the upper end of the multi-accumulator 16-bit machines, yet sells for about the same as most single-accumulator 12-bit machines. Price: $5,450.*

The faster, more powerful Nova: NOVA 800.

For the guy who wants more speed but doesn't want to spend much more dough, we've got the Nova 800.

Faster, more powerful than the 1200, Nova 800 has a fully parallel central processor and a basic cycle time of 800 nanoseconds.

But what makes it extra special is its extremely flexible IO structure that allows it to handle a heavy load of IO traffic of varying types and speeds.

Price: $6,950.*

We're more than machines.

O.K.

So now you know something about each of our new mini computers in particular.

Now we want to tell you something about all of our computers in general.

They're compatible.

The first Nova we ever built uses the same software, the same IO interfaces, fits in the same amount of space, uses the same peripherals as our new Supernova SC.

They offer systems manufacturers a range of machines and performance options that they can plug into a system without any modifications, all backed by as generous an array of discount schedules as you'll find anywhere.

We mentioned software.

We've developed a complete line of it.

Big computer software, designed, not scaled down, for mini computers.

Like ALGOL 60, FORTRAN IV, Time Sharing BASIC, and Disc Operating System.

The same goes for our peripherals: disc systems, industry-compatible mag tape units, paper tape equipment, card readers, line printers, real-time clocks, A/D, D/A, communications equipment.

As you can see from all of the above, we are and have been winning the mini computer battles.

Simply because we've consistently come up with the mini computers, and all that goes with them, that perform better and cost less than ever before.

To the victor go the spoils.

DATA GENERAL

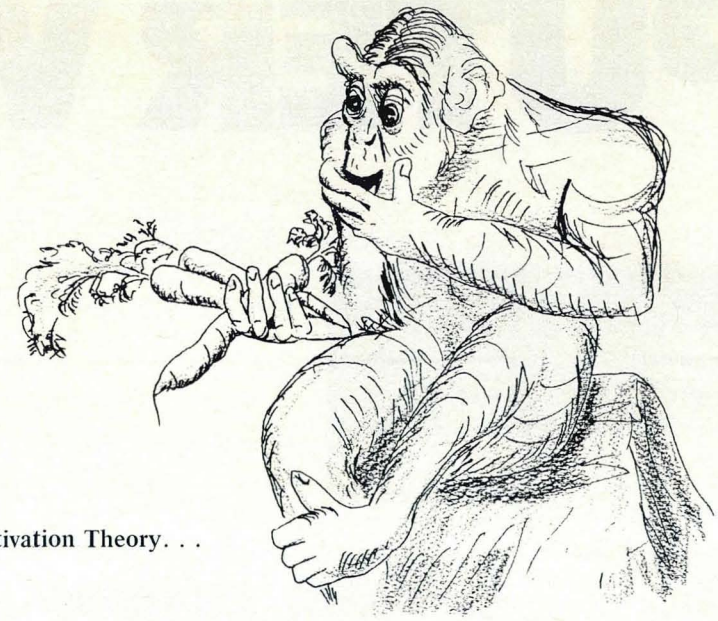
Southboro, Mass. *(617) 485-9100* / Hamden, Conn. *(203) 248-9660* / Commack, L.I., New York *(516) 368-3304* / Rochester, New York *(716) 235-5959* / Clark, New Jersey *(201) 381-3500* / Bowie, Maryland *(301) 262-1198* / Bryn Mawr, Pa. *(215) 527-1630* / Orlando, Florida *(305) 425-5505* / Chicago, Illinois *(312) 539-4838* / Richardson, Texas *(214) 231-4846* / Englewood, Colo. *(303) 771-0140* / Manhattan Beach, Cal. *(213) 376-7917* / Palo Alto, Cal. *(415) 321-9397* / London, England *0149-97735* / Munich, West Germany *0811-295513* / Zurich, Switzerland *(051) 34 07 77*. DATAGEN OF CANADA LTD.: Hull, Quebec *(819) 770-2030* / Montreal, Quebec *(514) 341-4571* / Toronto, Ontario *(416) 447-8000* / Vancouver, British Columbia *(604) 731-2711*.

**All prices shown are for configurations which include 4096 16-bit words of memory, Teletype interface, and Direct Memory Access data channel.*

FRITZ KINDERHAUFEN • Lajitas Mgt. Assoc., Alpine, Texas

UP THE SYSTEM DOWN-TIME

WHERE DID ALL THE FLOWERS GO?



Formalization Of Modern Psychological Motivation Theory. . .

The trouble with present thinking about motivation is that there are too many experts with unchallenged credentials telling each other what to think. It is thoughtless of them.

The collected experts have become a virtual industry dealing with the subject of motivation and, as is the case in other industries, no fresh thoughts on the subject should be expected from them. They talk with each other too much.

Those of you who have not been completely brainwashed in these currently accepted misconceptions about motivation will be the first to realize that **motivation is a natural, inherent characteristic of life and can be created neither by man nor by manager.** All forms of animals (man included) naturally seek food, shelter, and pleasurable stimulation **on their own accord** without being otherwise motivated to do so. Although this may seem to be a wildly radical concept to some, our job is not to motivate; but rather to **minimize those things we do to de-motivate our employees.**

Once one appreciates this fundamental truth, it is easy to see that the leading factors contributing to de-motivation are those things which we do to motivate. A case could be made that there is a whole youthful generation that has been so motivated by parents, teachers, and TV commercials that it has lost faith in just about everything; most particularly parents, teachers, and TV commercials.

Several large corporations have already seen the light and have stopped playing games with rubber tree plants, parking spaces, drapes, carpets, and the secretary to decorate them. Despite the dire predictions of the recognized motivational experts, this action has had phenomenally positive effects. It is just one more example that people are wonderfully motivated, if we can only stop motivating them long enough to find that out.

SELECTION CHARACTERISTICS

The systems organization searches for resourceful, innovative people with perception, drive, and all that other good stuff. The systems organization gets and keeps such people because it offers a higher monetary consideration and because dealing with computer systems is an I.Q. test that drives those who lack the aptitude out of their gourds.

Those who stay in systems development for a number of years are not nesters who like the routine of a rut. These people seek challenge and are happiest when they are "participating in the development of new things." They are poor at standing in line and tend to get bored doing things that they have learned all about. Thus they play bridge and chess but seldom bingo. If you put one in charge of an operating department, he'll generally get it going until he learns the job, then he'll get bored and let things get screwed up again.

When a systems man is challenged he will plug away, resenting only those things that seem to needlessly interfere with his project. It is only during the periods when he is unchallenged that he notices that he is over-worked and under-paid, and that his boss is dull and unimaginative. It is at

such times that the systems man is motivated to put out resumes systematically.

We try to select people who are resourceful and who constantly demand new challenge. Those who prefer routine eventually find their way into other operations. It should therefore be obvious that the most effective method of de-motivating systems people is to do the following:

- *Leave them unchallenged or idle, even briefly;*
- *Permit interference with their projects;*
- *Re-assign them to another project before they have achieved their objectives on the current one;*
- *Assign them (or promote them) to routine jobs;*
- *Con them.*

It is with great irony that we managers find ourselves doing these things, not only because it costs us good men; but also because these are the very things that frustrate the success of projects which we are hired to manage. It is even more ironic that we do these things systematically. (Do not stop to think, go directly to the next topic . . .)

PROJECT DEVELOPMENT AMONG THE APES

Things which are mass produced call for a relatively static production organization in which specialization can develop out of practice (monkey see, monkey do). This seems to be substantiated by the experience of Henry Ford and others.

Things which are not mass produced, but which are one-of-a-kind, call for a different kind of an organization. Since a detailed blueprint and specifications cannot be made available in advance, a great deal of judgement and competence is expected of the leader. Development of unique projects requires what has come to be known as project organization. (If your projects are not unique, go buy some software!)

The pure project organization is the oldest form of organization and sprang from the need for two or more men to gang-up on a bear. Something of the essence of true project organization was lost when these men began to **routinely** gang-up on bears, and began to specialize between bear-finding analysts and bod-to-bod contact men, or "closers" as they were then called. The first primitive **functional** organization was possible only because the objective (a bear) was understood by everyone and was a relatively standard entity. (Most bears look and act about the same.)

One thing which is common to both forms of primitive organization (project or functional) is that the leader decided how the rewards (bear components) would be split up. Otherwise, he would find some other gang to lead because **if you don't distribute the reward, you aren't the leader.** Analysis of primitive cave drawings on several continents has failed to yield a single exception to this policy.

Project organization is inherently more difficult because the project leader must continue to see that the objectives are defined and communicated within the project group. This explains why the most strikingly successful projects (inventions) are usually done by only one or two individuals. The communication of objectives on a one-man project effort is usually pretty good and such projects are normally under control.

It is only in modern times that we have become sophisticated enough to remove the function of reward distribution from project leaders and have placed the majority of the rewards well above the level of project control. In fact, we have become so expert at the science of management that one wonders why we have such trouble getting projects done.

It would be atavistic and reactionary to ask a cave man about project management; what could he know about organization and motivation?

WHY PLANTS GET POTTED

An industrial biologist acquaintance of mine is presently engaged in a project of some merit. His project has all the ingredients of success in that (1) he controls and communicates perfectly with his group (it is a one-man project), (2) he requires cooperation and support from no outsiders and, (3) he expects to share in the rewards of his work.

He is developing a hybrid carrot crossed with a stick which he hopes can be used as an all-purpose motivational device. He is encouraging the hybrid to grow by hanging fancy drapes in the greenhouse, carpeting the walkways, and using liberal doses of manure. He was considering the use of a rubber tree plant, but feared that this might constitute competition and therefore intimidate the hybrid.

He requested my advice, as a systems professional, but I could offer him none. After all, he was following all the conventional procedures. There is one thing about his greenhouse that I wonder about . . . ***Where did all the flowers go?*** ▲

WHAT HATH BABBAGE WROUGHT DEPT.

YOU'RE WELCOME, WELCOME, WELCOME

In an effort to solve its billing problems, the Clifton Springs Hospital has employed the services of a computer center.

The following note was sent as an explanation of the service for out-patients and internal accounting: "In an effort to provide you with faster, more accurate billing, we are using a computer for the first time. "This statement was automatically produced by our new ctmputer, untouched by human hands, human hands, human hands, human hands, human hands, 3 8& ??&$? "If it runs true to form, it undoubtedly will be wrong. 'It is it, please tell us. "Please don't get mad, get mad, get mad, get mad, get mad. "We won't either, either, either. "Thank you, thank you, thank you, thank you, thank you, thank you, thank you, thank you."

From the *Dallas Times Herald*, March 13, 1970.
Submitted by:
Stanley A. Bihari
Texas Instruments, Inc.
Dallas, Texas

MAYBE THEY DON'T OWN A COMPUTER

A few years ago I received a letter from Teacher's Insurance and Annuity Association (TIAA) informing me that because they have recently installed a computer, I could expect more efficient processing of all matter relating to my TIAA life insurance policy. I did not own any TIAA life insurance.

Submitted by:
Assoc. Prof. Leland H. Williams
Director, Auburn University Computer Center
Auburn, Alabama

REBFOB (REcursive Blountmanym FOr Blountmanym)

It often has been stated that the most successful computer people are those who can think up the best names for computer systems. These names are most often acronyms, or at least most people think they are. Actually, they may be acronyms, blends, counterwords or portmanteaus.

Therefore, to end all confusion and arguments as to whether a name is one type of word or another, I propose the word "blountmanym" (BLend, cOUNTerword, portMANteau, acronYM) defined as follows: A blountmanym is a blountmanym of all words in the dictionary which mean blountmanym. The beauty of this word is, of course, that its definition is recursive as well as being unambiguous.

Submitted by:
Richard A. Robnett
General Motors Corp.
Detroit, Mich.

BETTER EMPLOYEE RELATIONS THROUGH JCL

We had a computer operator who was continuously whistling and singing while running a computer located just outside our programming offices. Instead of complaining to the manager of the department, we added a JCL card to the program he would be running that day. Soon after he started the program, the machine stopped and the following message appeared on the console typewriter: CAUTION: WHISTLING AND SINGING MAY BE HAZARDOUS TO YOUR HEALTH. He got the point, there were no hard feelings, and everyone was happy.

Submitted by: E. David Clark,
Lawsson Milk Co., Cuyahoga Falls, Ohio

MODERN DATA will pay $10.00 for any computer- or EDP-related item worthy of publishing in our **"WHAT HATH BABBAGE WROUGHT DEPT."** Humorous "information" for consideration may include weird memos or operating instructions, unusually incongruous documentation, and off-beat items of a general nature (for review by our off-beat editors). Send all submissions to:

WHBW DEPT.
MODERN DATA
3 Lockland Ave., Framingham, Mass. 01701
Entries are the property of **MODERN DATA.**

Concept and design

Gilbert F. Curtis

An honors graduate of Princeton, Gil Curtis is perhaps the industry's most skilled designer of generalized business software systems. Certainly Curtis-designed systems are operating very successfully in literally hundreds of major corporations throughout the U. S.

From this experience evolved the obvious need for a powerful report generator. One that would be easy to use, yet so powerful and fast it could be used as a report utility as well as for on-demand reports. In other words . . . CULPRIT.

Design and implementation

Anna Marie was literally a co-designer of CULPRIT and the major implementor. A skilled programmer, Anna Marie was able to perform basic CULPRIT functions in virtually I/O time, thus making CULPRIT unbelievably fast.

Anna Marie was at one time a member of the staff of Arthur D. Little, Inc., engaged in product development. Later, she spent a number of years in software design and development. Mrs. Thron holds a B.A. degree in chemistry from Beaver College, Pa.

Anna Marie Thron

Interface with data base language

James J. Baker

Jim Baker is an M.I.T. graduate (math major and honor society member) who has completed requirements for his Phd at Harvard.

Prior to joining Cullinane Corporation, Jim spent 5 years in advanced software system development at I.B.M. Therefore, Jim was the logical choice to develop the IMS/data language 1 interface module . . . which allowed CULPRIT to enhance the report generator capability of DL 1.

Jim was also a major contributor to the OS version of CULPRIT.

Documentation

An engineer with a B.S. in E.E. from Michigan State, Ken spent many years in electronics research and software review and evaluation before joining Cullinane Corporation.

He authors a monthly column on software for Modern Data magazine and knows exactly what the user looks for in terms of really effective documentation.

So when Ken wrote the user's manual for CULPRIT he put himself entirely in the user's position. Example: he devoted a major effort to a self-teaching section for junior level personnel . . . but at the same time included substantial material for the advanced CULPRIT user.

Kenneth Falor

Meet the people behind the most important software package of 1970: new CULPRIT.

Before many months are out the chances are you'll be using CULPRIT. Wherever it has been shown it has generated intense interest. The list of sales is growing quite rapidly. And it is the type of package literally *everyone* needs.

So we thought you'd like to meet a few of the more important people behind it. There are others. Perhaps a dozen Cullinane staff members had some part in CULPRIT. But these are the four who deserve the credit.

CULPRIT brought us a few surprises. Particularly in speed. While we designed it for flexibility and ease in use CULPRIT turned out to be much faster than our most optimistic estimates. Otherwise it performs exactly as planned.

And what we planned was an easy-to-use report generator and information retrieval system that would allow you to respond to on-demand report requests regardless of report complexity. One that was so efficient it could be used as the report utility in production systems.

How CULPRIT differs

Many report generators can produce only one report from one pass of the data file. Others produce a Cobol program which must be compiled, link edited and run before they produce a report. Some even have both problems. That's Model T designing!

CULPRIT is a parameter-driven program. No compiling needed. The program is kept on the core image library like a utility and produces a report as directed by the parameter coding. Highly efficient, it produces many reports (up to 99) with a single pass and can extract from multiple input files.

CULPRIT requires from 1/10 to 1/40 the normal coding time. This means that the most junior-level programmer can request and get a simple one-time report in minutes. Or many complex reports in one pass . . . with just a few hours of coding. Not weeks. Hours! But fast reports are not all that CULPRIT can do for you.

New Systems

When you design a new system, how much of it is made up of report editing programs? Half? A third? Then you can put your new system on the air nearly one-third to one-half sooner by simply plugging new CULPRIT into the system to handle the reporting requirements. You not only save programming time, but the machine time usually needed for debugging this part of the system.

Processing speeds are close to those for well-designed and laboriously hand-coded programs. Remember . . . this isn't an ordinary report generator. You just load and go.

Features

CULPRIT has multi-line output for address labels, notices, etc. Other options include header variables; multiple-lines in headers, detail and totals; separately specifiable total lines; calculation ability on both detail and total levels; use of memonics for working fields; and many others. Output may be printer, punched cards, tape or disk . . . permitting program and test file creation and conversion.

Find out for yourself!

Send for a complete 15 page technical report. Or, if you'd rather discuss CULPRIT directly with one of the above people (or equally well-qualified Cullinane staff members), pick up your phone and dial (617) 742-8656. You really ought to know about CULPRIT. Don't pass up the chance!

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60 State St., Boston, Mass. 02109 Phone: (617) 742-8656. Other offices in New York, St. Louis, and London.

"Twas The Nite Before Printout"

by **JACK LUDWIG**, King-Of-Prussia, Pa.

EDITOR'S NOTE: We hope (pray) that you are adequately immersed in X-Mas Cheer (crocked) by the time you read this section. A clouded mind and shaking hand are needed to fully appreciate the depths of datistic genius that went into the composition of this Holiday Ode. Many attempts on our FUTILE-I computer to machine-generate a suitable ode had failed, and we were rescued (?) from our de-prosed position by the efforts of Jack Ludwig. (No relation to Mad Ludwig of Bavaria).

'Twas the run before Compiler, when all thru the shop
Not a programmer was logged in, not even an OP.
Source listings were laid by circular files with care,
In hopes that Saint Recovery soon would be there.
The programs were nested all snug with their tapes
While divisions of COBOL-runs typed in new dates;
And Mac in his edit and I in my demo
Had just settled our specs for a long GSA memo,
When out of the scratch disk there arose such a clatter,
I spring to the printer to read out the data.
Away to executive I load like a flash,
Tore open directories and spewed out the crash.
The dump on the breast of the just fallen buffer
Gave a listing of diagnostics it had suffer'd
When what did its sputtering diodes reset
But a miniature Sigma and an eight-bit cassette.
With a little old OPSYS, so livid and slick,
I knew in a monitor it must BPMick!
More rapid than edits his errors they shame,
And he jingled and clouted and called them by name.
Now COBOL, now ALGOL, now BASIC and TRACE,
On CONSOLE, on CHANNEL, on SYSTEM, and PACE.
To the top of the QUEUE, to the top of the goal,
Now Stack away! Stack away! Stack away, Boole.
As dry runs string before a wild cascade tree
When met with a job stack that will mount in ASCII.
So up to the tube-top the cursors they skew
With Sigma full of noise, and St. Xerox is too.
And then on a terminal I heard it was loose
The crashing and stalling from each client's use.
As I keyed in my ID, and was deleting file pools
Down the OPSYS St. Xerox came with granules.
He was labeled in ferret, from his tape to his disk,
And his drives were all hollerith'd with Tsk! Tsk! Tsk! Tsk!
A bundle of I/Os he had flung to disk pack,
And he looked like a novice just gaining his knack.
His guides how they twingled! His manuals did scurry.
Diagnostics like oxes, his modes like a flurry.
His droll little macro drawn up like a load,
And the arm of his access as fast as a toad.
The stump of a byte he held light in his core,
And the smoke, it encircled his panel some more;
He had a broad base and a little round tele
That shook when he typed like a bowl full of jelly.
He has FORTRAN and BASIC, from right off the shelf,
And I laughed when I saw him, in spite of myself.
A blink of a lite and a twist of a dial
Soon gave me no feeling or reason to smile.
He wrote not a word (32 bits) but went straight to time down,
Then zeroed all storage, and burned with no sound;
And displaying his status astride microfiche
And giving a NO-OP, the OPSYS unleash'd.
He sprang to his monitor, to his beam gave a missile,
And astray they all blew like the down of a thistle.
But I heard him exclaim ere he plotted out logic,
"Seven Sigmas To All And To All A New Project."

BYE, BYE, BUCK-A-BIT.

Say goodbye to former notions of modem price/performance. Our new DigiNet TDM-330 will do more for much less.

If you want to use all of the speed your peripherals have built into them, you'll want to meet the TDM-330.

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No more maintenance hang-ups—a screwdriver to replace a unit with a spare is all that's needed.

The TDM-330 is equipped with a built-in test facility and an automatic line equalizer for easy installation and maintenance.

It interfaces to your data terminal or controller with a standard EIA RS-232 connector.

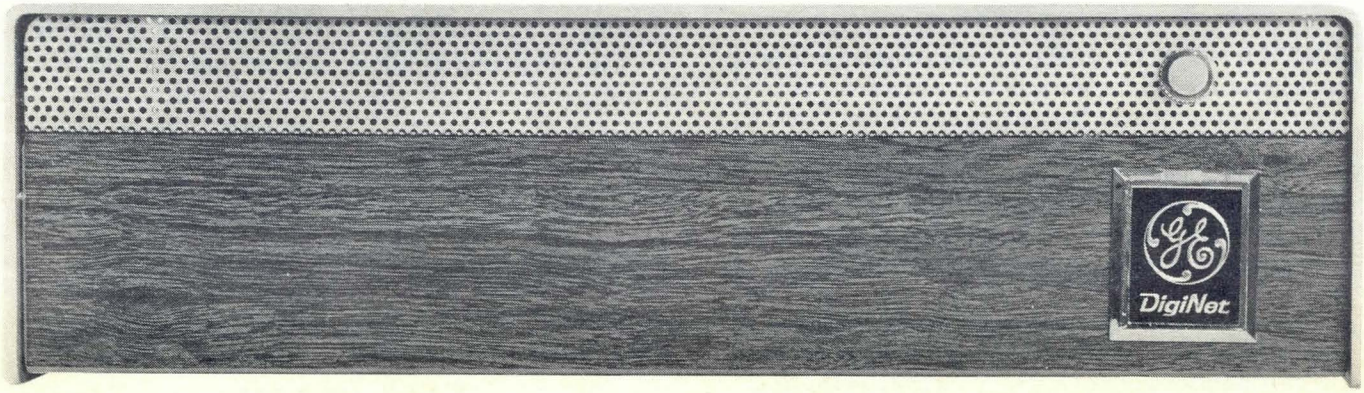
Best of all, it's here—ready to let your peripherals operate at rated speed.

Say goodbye to buck-a-bit notions.

Say hello to our DigiNet TDM-330.... at only $925—and 9.6¢ per bit.

Inquiries and orders to Wayne Evans, Telecommunication Products Department, General Electric Company, Mountain View Road, Lynchburg, Virginia 24502.

GENERAL ELECTRIC



GE'S NEW 9600 BPS SHORT-HAUL MODEM

CIRCLE NO. 33 ON INQUIRY CARD

ROBERT A. O'HARE, Marketing Mgr. • Delta Data Systems, Cornwall Heights, Pa.

TECHNOLOGY PROFILE

MODEMS & MULTIPLEXERS

Thanks to Tarriff 263, modems from competitive (non-Bell) sources can now be connected to the public telephone network through a low-cost control signalling device called the Data Access Arrangement (DAA).

Since DAA connection is possible, any user contemplating the purchase of modems should look at what is available from independent manufacturers. Because of the competition and advances in the technology, a buyer has the possibility of designing a higher performance communication system for lower cost.

The number of remote terminals being connected to computer systems through telephone lines is increasing daily, and the line costs associated with such terminals are also increasing. Multiplexing, a technique that allows more than one terminal to share a single telephone line, is a way in which these line costs can be reduced.

MODEMS

The two worlds of digital-oriented computer data and analog-oriented transmission line data must be interfaced if a remote terminal is to communicate over telephone (analog) lines. The unit that converts a serial string of computer bits to transmittable form is a modulator; the unit that receives the modulated information from the transmission line and converts it back to a serial stream of computer bits is a demodulator. Since most computer communications systems transmit and receive data over the same pair of wires, the modulator and demodulator are physically located in the same framework. The fundamental name of this combination is MODEM, an acronym for **MO**dulator-**DEM**odulator. Bell calls their modem a dataset, and both of these names are universal.

EDITOR'S NOTE: This Profile surveys communications equipment used in the transmission of computer data over telephone lines. The main part of the Profile covers the operation and selection of modems and multiplexers, and tabulates some of their parameters. This Profile also contains separate articles giving specific guidelines on selecting multiplexers and the emergence of integral modems in future communications markets.

The number of manufacturers and models produced necessitated the exclusion of acoustic couplers in the modem portion of this Profile. MODERN DATA will cover such communications equipment in a future Technology Profile.

A modem is used to terminate each telephone line in the system. Modems are required at the computer site and with each remote terminal device.

Comparing Modems

All modems are used for the same purpose — to modulate and demodulate digital data so that the data can be transmitted over great distances on analog lines. The primary points of comparison are line conditioning requirement, modulation method, figure-of-merit, error performance in the presence of noise, and options.

LINE CONDITIONING — The standard dial-up voice-grade telephone line normally used for voice telephone calls and a part of what is called the DDD network is unconditioned — meaning that it meets specified minimum line requirements. Depending on the particular modem design and the desired transmission rate, the minimum unconditioned line may not be adequate. For example, the Western Electric (Bell) 202 dataset can operate at 1200 bps on dial-up lines, but can run at 1800 bps on private lines that have been conditioned. Special engineering by the phone company conditions the lines for better performance, and such lines are available to the user at an additional cost. The line condition requirement is important to modem comparisons because of such costs.

MODULATION METHOD — The modulation method is important because it directly relates to error per-

formance and the bandwidth requirement. Modulation methods vary considerably because each modem manufacturer tries to find the optimum method. They design for maximum bit rates over voice grade lines, high figures of merit, and low cost.

FIGURE-OF-MERIT—The figure-of-merit, m, relates the transmission rate of the modem with the bandwidth required to achieve that rate, and is defined as m bps/cycle of bandwidth. It is a measure of how efficiently the modem is utilizing the bandwidth available. As m increases, however, modem costs go up, and the system is more susceptible to noise.

ERROR PERFORMANCE — Transmission circuits are electrically noisy, and the demodulator must expect to operate with short bursts of interference called impulse or white noise. As the transmission rate or the figure-of-merit increases, one must expect to have a higher number of errors in the system and a more expensive network of conditioned lines and modems. Reasonable error performance permits one error in 100,000, or 1 million bits on the average. An error figure might be written as 10^{-6} for 1 error per million bits.

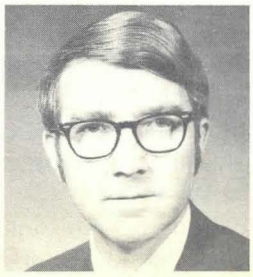
OPTIONS AND PARAMETERS — The options available on modems, and other performance parameters must be considered because they relate to over-all system cost and response time. Options and parameters that may not be self explanatory are explained below.

- ***Turn Around Delay*** — *Time between a terminal transmit request and the OK to transmit.*
- ***Carrier-On Delay*** — *Allows the signal to build up at the receiver before it is checked for incoming data; prevents false inputs.*
- ***Release Carrier-On Delay*** — *Time required for the indication to turn-off once the input data flow has stopped.*
- ***New Sync Or Squelch*** — *Gives computer ability to stop the carrier so that carrier release delay can be greatly reduced. Improves efficiency of multipoint operation.*
- ***Equalization*** — *Built-in equalization obviates the need for leasing conditioned lines.*
- ***Clamp*** — *Holds receive data line in marking state until carrier is truly on.*
- ***Soft Carrier Off*** — *Transmitter sends 900 Hz tone that turns receiver carrier detector off before noise could be present on receive data line.*
- ***Built-In (Integral)*** — *The modem without case and power supply, is made to be incorporated in the terminal equipment.*
- ***Reverse Channel*** — *A narrow channel that permits signalling in the reverse direction on a two-wire circuit without the need to turn the line around.*
- ***Local Copy*** — *Permits transmitted reverse channel data to be read at reverse channel receive output of same modem.*

Synchronism

The transmitter and the receiver must both be running at the same rate of speed and synchronized so that the receiver can recognize the intelligence that is being sent. Modems use two synchronizing methods, synchronous and asynchronous.

Asynchronous transmission means that the time between the transmission of any two data characters is not defined. The characters can follow contiguously, or they could come minutes apart. The main reason for this type of transmission is to ac-



Bob O'Hare graduated from Newark College of Engineering in 1957 and has a Masters Degree from the University of Pa. His 13 years of experience in the computer industry encompasses engineering, manufacturing, marketing and sales, and covers computer communication systems, peripherals, and remote terminals.

Bob spent ten years with Univac and was an independent consultant in computer communications.

commodate cases where human operators might be keying data into the system, and it is quite commonly used with Teletype and common carrier papertape services.

In **synchronous transmission**, the entire transmission period is divided into fixed pulse periods. Each data character follows the other contiguously and the first bit of the second character fills the pulse period immediately following the last bit of the first character. Timing is achieved by a synchronous clock which is accurate enough to time an entire stream of data bits.

Traditionally, synchronous datasets are used with synchronous terminals, and the crossover from asynchronism to synchronism is made when the efficiency of synchronous transmission overcomes the slow speed and lower cost of asynchronous transmission. With the better choice of modems, however, and their high speed and lower cost, the ease of upgrading asynchronous terminals to higher speeds will lead to many systems utilizing synchronous modems to transmit asynchronous data.

Interface

The modem interfaces the transmission line facilities on its analog side and the computer hardware on its digital side. In order for the modem to interface correctly with the system, three conditions must be satisfied. First, the modem data rate, the operating mode, and the line conditioning must be compatible; second, the physical connections of the equipment and the access arrangement must be compatible; and third, specific leads must be available at the interface and controlled according to predefined discipline.

The operating mode could be simplex, half duplex, or full duplex, and the line interface could be two- or four-wire private line, or two-wire connection to the switched voice network. If private lines are used, they may have to be conditioned to meet the data rate requirements. If the connection is made to the regular voice network, then compatibility must be achieved for one of the following interfaces leased by the telephone company (the last three items are for the attachment of non-Bell devices to the telephone line): dataset (Bell modem), automatic calling unit (Bell), data access arrangement, automatic data coupling unit, and automatic originate and answer unit.

The computer communication system doesn't have to know a thing about the analog interface. The digital interface is the area where the total system controls its communications portion, and it must be given considerable attention. The three standard digital interfaces are Electronic Industries Association Standard RS 232, the standard in the USA; MIL STD 188B, used with kryptographic gear; and the international standard, CCITT.

Operation

For the following operational descriptions, synchronous transmission from a data terminal to a computer is assumed.

TRANSMIT — In half duplex operation, the dataset is normally waiting in the receive condition. When the data terminal wants to transmit, it must make a request to the modem. The modem initiates an echo delay, puts carrier on the line, and starts the transmit clock running. At the end of the echo delay period, a clear-to-send indication and the transmit clock are sent to the data terminal from the modem. The terminal, using the modem clock as a strobe, then shifts its data out to the modem. After the data is sent, the terminal terminates its request, and the dataset drops carrier and clock.

In a four-wire system, the echo delay period can be eliminated as there are two wires for transmission of data in each direction, and the modem can be transmitting and receiving carrier simultaneously. In such a situation, the machine is always clear to send and will always have the transmit clock at its disposal.

The echo delay is a real problem in two-wire circuits because it could reduce the effective transmission rate by 50%. The total delay, 250 ± 100 msec, is activated each time the line is reversed to accommodate data flow in the opposite direction, and is required to let all line echos fade away and to establish echo free carrier in the opposite direction. If four-wire lines are used and the data terminal still controls the send request, the delay is reduced to 8.5 msec. No delay is required on four-wire lines when continuous carrier is used.

RECEIVE — When power is turned on, an interlock or ready signal is sent to the computer. In this condition, the modem is ready to receive, and will stay in the receive condition unless it receives a send request. A carrier detector indicates to the computer that data is forthcoming and that the remote end has activated a send request. In the full duplex, continuous carrier mode, this signal is used to indicate that a connection exists. A clock or timing signal for ensuring synchronism is also sent to the computer in conjunction with incoming data; in most modems, the clock is derived from the incoming modulated signal.

In multipoint operation, the computer has to wait for the clock to fade out before it can attempt to solicit input from another party on the line. If

the modem is equipped with the new sync option, it can squelch the incoming clock so that the computer can poll, or call, the next party in a much shorter period of time.

ANSWER — Modems have the capability to answer and terminate calls when they are used on a switched voice network. The transmit modem sends a signal to the computer to indicate that someone is trying to call, and the receive modem can answer by sending a control signal back in response. To hang up, the computer simply removes its control signal.

Modulation Methods

Many modulation methods have been employed to transmit efficiently and with the greatest amount of information per signalling element.

The three basic modulation methods are amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM). Designers attempting to increase the figure-of-merit of their modems have developed sophisticated variations on these modulation techniques that permit the transmission of more information per unit of time. The most popular methods are frequency shift keying (FSK), duobinary FM, amplitude phase modulation, AM vestigial sideband (VSB), and differentially coherent phase modulation.

FREQUENCY SHIFT KEYING — FSK is a system in which two possible states of a binary digit are represented by a series of signal elements having constant amplitude and one of two frequencies. This simple method has a figure-of-merit, m = 1.

DUOBINARY FM — Duobinary FM, with m = 2, uses three signalling frequencies instead of two. The center frequency represents a "zero" and the two outside frequencies represent a "one". Because the "one" frequency always relates back to the frequency of the previous "one," the code has some error detection capabilities, produced without the transmission of redundant bits.

PHASE MODULATION — It is difficult to derive a reference from a phase modulated system, so a differentially coherent phase modulation is usually used. In such a system, each signal element is stored one element time, and the phase change between successive elements provides system coherence and the desired reference.

• ***4-Phase Modulation*** — *Differentially coherent 4-phase modulation is used by the WE 201 and 301 datasets. It has the good features of phase modulation but only achieves a figure-of-merit, m =1.*

Data is encoded on the carrier frequency as a succession of phase shifts. From one signal element to the next, the phase shift will be 45°, 135°, 225°, or 315°. Each phase shift contains two bits of information which are called dibits. They are related as follows (dibits-phase change): 00-225°; 01-315°; 11-45°; 10-135°.

The system is coherent because the bit pairs can never be transmitted without a phase change between them. For example, when all zeros are transmitted, the phase angle changes every dibit time by 225°.

• ***8-Phase Modulation*** — *The Milgo modems use 8-phase differentially coherent modulation. This coding scheme is very efficient, conserves bandwidth, and has an m = 3.*

At 2400 bps, no line conditioning is required; 4800 bps does require line conditioning, but the conditioning circuits are located in the modem. This means that unconditioned, and therefore less expensive, telephone lines can be utilized.

As with 4-phase modulation, the intelligence is transmitted as a phase shift encoded carrier, and the receiver detects the relative phase of two adjacent signals from the demodulator. The system is differentially coherent because the present phase can be decoded only if the last phase is known.

PHASE SHIFTED AM/PHASE SHIFT KEYING (PSK) — The Collins modem achieves 4800 bps by combining 4-phase differentially coherent phase shift modulation in conjunction with amplitude modulation. It operates over voice grade telephone lines that have been conditioned to the level of C4, and transmits just about 2 bps/cycle of bandwidth (m = 2).

Three bits/tone element are encoded by shifting two bits into a phase encoder and one into an amplitude encoder. The phase encoder compares the phase of the previous element with the new bits and selects a phase appropriate to the comparison. The phase modulated signal is then subjected to the status of the third bit which will either pass the signal unmodulated or modulate it by 60%.

MULTILEVEL VESTIGIAL SIDEBAND AM — This modulation method encodes information into more than two levels of amplitude (typically four). Although AM is relatively simple and low in cost, multilevel AM is sensitive to noise, and requires a broad bandwidth.

Approximately 40% of the bandwidth can be preserved by using vestigial sideband (VSB) transmission which filters out all but a vestige of the upper sideband. AM generates two sidebands that are symmetrical about the carrier frequency, and each sideband contains the same information.

Continued on Page 65 . . . . . .

JON BLASDELL, Mgr. Mkt. Dev. • International Communications Corp., Miami, Fla.

SELECTING A MULTIPLEXER

Multiplexing is rapidly becoming a recognized economic factor in the data communications industry, and selection can be a difficult and time-consuming task. The following text lists important criteria which should be considered when selecting a multiplexer.

WHY MULTIPLEX?

By multiplexing, multiple-access and on-line data processing systems can concentrate the data from a number of terminals at one remote location. The concentrated data can then be routed to the central processing unit over a single duplex leased telephone circuit. In such an arrangement, the cost of the single phone circuit is much less than the multiple line charges which normally result from leasing a circuit for each remote terminal. In these systems, the multiplexer's primary purpose is to transfer a quantity of data at lower cost.

SYSTEM CONFIGURATION

There are generally several ways a system can be configured. The first task is to examine each and determine the optimum approach. Future expansion is an important point to remember; many times, a multiplexer that appears to be extremely economical in a present system becomes obsolete as soon as the system is expanded.

TRANSPARENCY

In any system configuration, the multiplexer must be a transparent device (the output must equal the input). Frequency-Division Multiplexing (FDM) and Time-Division Multiplexing (TDM) bit-interleave multiplexers are data transparent. However, they are less efficient than the transparent TDM character-interleave technique, which is becoming a standard with multiple access on-line data processing systems.

Multiple access systems generally utilize the dial network; the "handshaking" routine required to establish a communication link between a terminal and a computer utilizes certain control signals. A multiplexing system must be transparent to these signals. Different systems may require different control signals; a multiplexing system must be able to handle all possible combinations of signals, or it must encompass a flexible design that provides easy adaptation in the different systems to which it may be applied.

There are multiplexers available that lack the required transparency. Some character-interleaved TDM's are not data transparent. They use two or more code combinations for internal control; other multiplexers are not control signal transparent. When selecting a multiplexer, make sure that the requirements for transparency are satisfied.

FLEXIBILITY

A multiplexer that has been designed from an applications approach should be selected. It will provide many features and benefits which will prove more flexible in any system.

Some examples of current multiplexer flexibility include: **Speed/Code Intermixing** – The provision for intermixing different terminal speeds and codes. **Channel Flexibility** – Most multiplexers base the number of channels available on the highest terminal speed and are less efficient; others are able to use the high-speed line by scanning the low-speed inputs at varying rates. These units always prove equal to, or better than, the fixed rate type. **Speed Flexibility** – Although most multiplexers are designed to operate with only a few select high-speed outputs, some can operate at any speed up to 9600 bps. Choose a unit that can be upgraded to a higher transmission speed with a minimum of trouble and expense. **Location Flexibility** – Some multiplexers are designed to fit into a system at a specific location (the computer site, the remote site, or a

mid-point in a distributed configuration). Units of this type can cause logistics problems as a data communications system expands or changes. An important selection criteria should be to insure that all units can be used at any of the various locations within the system. **Software Demultiplexing** – The ability to use the main computer or a peripheral processor to perform the multiplexing/demultiplexing function at the computer site, while not currently implemented in most systems, is an important consideration. The hardware savings that can be realized effect both multiplexer and computer cost. When hardware demultiplexing is used, each slow-speed input/output must be provided with a companion low-speed computer port. When software is used, only one high-speed synchronous port is required. The economic evaluation is the cost of a custom software program vs. the hardware savings. As the quantity of lines increase, the software cost ratio decreases. Therefore, choose a multiplexer whose message format lends itself to software demultiplexing by the computer system.

EQUIPMENT RELIABILITY

Data communications systems are required to operate around-the-clock with only minimum downtime for update and maintenance. Although most multiplexer designs use a high degree of reliable components, not every manufacturer performs the testing required to insure a reliable field unit. Select a unit that has been subjected to a rigorous pre-shipment 100% burn-in and testing procedures.

DATA RELIABILITY

Many times engineers design circuitry that will remain operational in adverse conditions, but will occasionally cause data to be changed or misinterpreted. The multiplexer must feature design techniques that provide for reliable data transfer.

COSTS

There are many ways of looking at what a unit costs. The price tag on the multiplexer itself is not the only significant factor. Other contributing factors include: **Line Required** – While units generally require a 4-wire, full duplex type 3002 data circuit, there are some systems that could be configured with half duplex lines. Consider the type and cost of the leased line as a portion of the system cost. **Modems** – Many systems require two modems, with the multiplexers located at the midpoint; others can operate with only one per multiplexer. The type of modem required is also important; select a multiplexer that is compatible with as many modems as possible in order to achieve the optimum. **Number Required** – A system which may require a certain number of one type of multiplexer may be configured with a smaller quantity of a more sophisticated type that can handle more channels on a given circuit. **Shared Channels** – Some systems achieve significant savings when channels are allowed to contend with each other. If contention is applicable, make sure that the multiplexer can support this feature.

Other cost-considerations are how much does it cost to keep the unit in operation, and how long does it take to isolate problems and replace components that have failed? To assure maintainability, be certain that the unit features modular design and has some maintenance analysis ability built in. Over-instrumentation, however, may provide more analysis ability than is necessary and serve as a confusion factor rather than an aid; it may also add to maintenance problems.

COMPATIBILITY

Select a multiplexer that is compatible with the rest of the data communications system. Consider the interface levels, code format, and control signal capability. Some units do not fit into just any system, but are custom de-

signed for a particular application. Some multiplexers are not compatible with software demultiplexing and some units do not pass all of the AT&T control signals.

Upward compatibility is another consideration. Be sure that the selection of a multiplexer does not create a situation of obsolescense. As technology advances, some units lose their usefulness. Select a unit that has the greatest upward compatibility – one that can be modified in the field with plug-in options.

SUMMARY

In the final analysis, the deciding factor in making any purchase decision is economics. Unfortunately, resolving all of the various trade-offs to arrive at a true evaluation of the economic differences is not simple. The main points of this discussion have been condensed into the following "checklist" to aid in the selection of the right multiplexer for your system.

MULTIPLEXER CHECKLIST

MULTIPLEXER FEATURE	OPTIONAL PARAMETER
Data Transparency	✓ Capable of passing all codes?
Control Signal Transparency	✓ Capable of handling all possible combinations of control signals?
Speed/Code Intermix	✓ Capable of intermix?
Channel Flexibility	✓ Fixed rate input scanning? ✓ Varied rate input scanning?
Speed Flexibility	✓ Operate at any speed up to 9600 bps? ✓ Operate at select speeds only? ✓ Capable of having speed upgraded with minimum expense?
Location Flexibility	✓ Operate at only one site in the system? ✓ Interchangable with other units at other sites in the system?
Software Demultiplexing	✓ Capable of operating directly with main computer or peripheral processor? ✓ Not capable of operating directly with main computer or peripheral processor/ requires another multiplexer as interface?
Equipment Reliability	✓ Manufacturer has proven history of reliable products? ✓ Units are in use and field tested?
Data Reliability	✓ Has ability to pass valid data reliability?
Line Requirments	✓ Requires four-wire full duplex type 3002 data circuit? ✓ Can be configured with 1/2 duplex lines?
Modem Requirements	✓ Multiplexer is compatible with many modems? ✓ Each multiplexer uses only one modem?
Number of Units Required	✓ System is configured to efficiently use minimum number of multiplexers?
Contention	✓ Has contention capability?
Maintainability	✓ Multiplexer has modular design? ✓ Has built-in analysis ability consistent with reliable performance?
Availability	✓ Has delivery schedule consistent with system requirements?
Compatibility	✓ Is compatible with all other elements in the system?
Upward Compatibility	✓ Can be field-modified with plug-in options? ✓ Is designed to accommodate system expansion without unit replacement?

The information can be decoded if the demodulator receives one complete sideband, the carrier frequency, and a small portion, or vestige, of the other sideband.

Digital data to be transmitted is encoded two bits at a time into one of four levels of amplitude, and before modulation, it is usually added to a reference signal in order to improve the noise sensitivity. The four level analog signal is then modulated and the upper sideband cut off.

Equalization and Error Control

To equalize a telephone line means to compensate for distortion produced through amplitude attenuation and different amounts of signal delay at various frequencies. Equalization becomes necessary when broader bandwidth is needed for higher transmission rates. A conditioned line, available from the phone company, is equalized by them; if conditioned lines are leased, equalization is not necessary in the modem.

To provide more flexibility and better economics, equalization is often built into the modem. Some modems use manual equalizers; the latest variety of modems incorporate automatic equalizers that provide for system start-up without manual tuning.

Line equalization, whether automatic or manual, built in or leased from AT&T, is accomplished in the analog domain rather than the digital, meaning that the necessary adjustments affect the amplitude and delay of the modulated frequencies rather than the demodulated digital pulse pattern. Adjustment made in the digital domain, adaptive digital equalization, is fairly expensive to perform and is not yet in common use. It is, however, a significant advance in modem technology.

Codex Corporation has a patent pending on their adaptive digital equalization technique which allows substantial improvement in transmission speed. Codex can achieve 9600 bps over a C2 line. They use multi-level VSB AM with their adaptive equalizer and provide a modem with a figure-of-merit, $m = 4$.

Adaptive digital equalization utilizes a repetitive pattern of binary bits that is transmitted as a reference signal. The receiver gets in (and stays in) synchronism with the transmitter by comparing the received reference signal with an identical pattern generated internally. The digital adaptive equalizer maintains equalization by comparing automatically and continuously the averaged transmitted reference signal with the local replica.

The Datamax Corporation takes the process one step further by using many of the techniques employed by Codex, and adding forward error correction. Forward error correction means that bit or

burst errors detected at the receiver can be corrected without any retransmission. This error process has been used in military and secure systems, but complexity and expense has kept the process from being applied in commercial modems.

The transmitter of the Datamax unit has a convolutional encoder that interleaves parity bits with the binary data stream. Their encoder adds 50% redundancy, or 2400 bps, to their 4800 bps data stream, and interlaces them. The resulting 7200 bps are transmitted to the receiver.

The receiving modem has a threshold decoder that compares a number of equations that use the incoming data bits as variables. One bit at a time is considered for correction before being passed on to the system, and if the data has been corrupted by random bits or bursts of noise, the error bit is changed (corrected). The resulting data stream of 4800 bps has a very high probability of being free of errors.

MULTIPLEXERS

Multiplexing, which is not a new art, can save money because it is a technique that provides more efficient use of circuit bandwidth and more efficient use of the time available for transmission. Multiplexing permits many terminals to share one telephone line.

The technique is best employed when a number of remote terminals, located reasonably close to each other, require long dedicated (private) phone lines all the way back to one computer site. One multiplexer at each end of one long dedicated phone line allows that phone line to be shared by the many terminals, and thus the high cost of lines to each and every terminal can be eliminated. The decision to multiplex or not depends on the comparison of multiplexing equipment cost versus the cost of the phone lines.

There are two ways to multiplex information onto one telephone line. The channel bandwidth can be divided into a number of narrower frequency bands that are isolated from each other; or the real time that is available can be divided into a number of smaller time segments. The first method is called frequency-division multiplexing (FDM) and the second method is called time-division multiplexing (TDM). Both systems are digital (EIA or ®S232) end-to-end and interface modems at the remote terminal end, while directly going into the communication subsystem at the computer end. In all cases, the circuits appear independent to the user.

An FDM system must divide the existing 4KHz channel (voice grade line) into smaller bands that can handle the low-speed data rates. This is done with band-pass filters which have characteristics that cause a loss of usable bandwith between channels. Once the filter characteristics, the usable channel bandwidth, and the necessary narrowband requirements are defined, the number of derived narrow bands is fixed. If more narrowband channels are required, another FDM system must be installed.

TDM provides more economical use of a voice grade telephone line by translating a number of slow speed inputs into a high-speed output. Each input has its own time slot in the high-speed stream — like box cars on a train — and at the other end of the line the contents of the box cars are placed into their respective output locations. The system might interleave channel data by bit, or by character; in most cases it is flexible enough to handle two or three input data rates, various code lengths from 6 to 11 bits/character, and one or more stop-bits/character.

A TDM system has greater capacity than FDM, utilizes bandwidth more effectively, and is readily expandable. For example, 16 terminals at 150 bps can be multiplexed onto one voice grade line with a 2400 bps modem. The system capacity can be doubled by going to 4800 bps instead.

However, FDM has advantages over TDM. It is less expensive, if the number of remote terminals is less than 16, and can be more economically implemented when the terminals must be dropped from a party line, with a small number of terminals at each drop-off point. This is because the FDM hardware is channel-oriented, while the bulk of TDM hardware is required at each site regardless of whether that site has one or twenty terminals.

Comparing Multiplexers

All multiplexers are used for the same purpose — to reduce the total network cost in a computer communication system. The primary points of comparison are system capacity, speed intermix, multiplex method, operating modes, transparency, and test and fallback facility.

Systems always expand, so the ability to add more channels is important. In TDM systems it means the ability to use higher speed output modems with no change in slow speed characteristics; in FDM systems it means the addition of modular circuitry for the additional channels. Consideration must also be given to the development of multipoint systems and the potential requirement of multipoint expansion.

The terminal types and the location of the terminals in the network should initially be approximated without regard to any particular multiplexer. After the initial layout, the multiplexer requirements should fall into place and pro-

vide a basis for comparison. The terminals determine the present speed intermix; the quantity of terminals and their clustering determine the operating mode (point-to-point, multipoint, or concentration); the cost (considering expansion) should determine the multiplexing method.

A transparent multiplexing system is one that can be inserted between terminals and computers without either piece of hardware knowing about the insertion. This is a prime consideration when the initial system allowed the terminals to dial a long distance connection to the computer and the modems had to recognize the ringing line, indicate the presence of carrier, and note the operative condition of the computer. A transparent multiplexer will pass these signals from end-to-end, and hardware does not have to be altered.

If erratic performance due to system degradation is not tolerable, then fallback and test facilities are an important point of comparison. Loop back switches and speed shifting become helpful system features.

FDM System Description

A typical FDM system can multiplex 15 full duplex data channels, in increments of three, onto a four-wire telephone line. This system may be point-to-point, or multipoint. The line may have to be conditioned depending on system capacity. At the remote multiplexing location, the interface plugs into 300 bps 103-type modems to handle data rates of 110, 134.5, and 150 bps. At the computer site, no modems are necessary, and the multiplexer interface plugs into the communication subsystem directly. The Ring Indicator, Carrier Detector, and Data Terminal Ready leads of the RS 232 interface are utilized at the remote end because every remote terminal dials into the FDM system. These signals are passed on through the system and appear at the communication subsystem interface as if the dataset were directly connected.

The terminal would dial a local number and be connected through an acoustic coupler or modem to the remote multiplexer location. Signals are then translated in frequency to a higher system frequency and sent to the demultiplexer at the computer end. The demultiplexer will demodulate the analog signals, convert them to digital data, and pass the data on to the communications subsystem.

TDM System Description

A typical TDM system can multiplex 16 inputs at 150 bps and will transmit 2400 bps over the private telephone line. Higher speed TDM is also

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Intertel, Inc., Burlington, Mass.

AS MODEMS BEGIN TO "DISAPPEAR"

Selection of modems for dial-up telephone line application prior to 1969 was simple – call the local telephone company. The FCC Carterfone ruling opened the way for independents to supply modems, giving end users a choice of vendors. However, during most of 1969, non-Bell modems were offered only in free-standing configurations (i.e., enclosed in a separate cabinet with power supply, cable, and connectors).

Today end users can choose to have the modem incorporated into the terminal (integral). The question is – should the end user care whether his modem is integral or free-standing? Cost, reliability, operator convenience, vendor relationships, and system packaging are key differences.

Modem cost has become an important factor in total system cost as less expensive terminals appear. Looking at 103-compatible modems as an example, rental from Bell totals $300 per year plus an initial installation charge, with no purchase or lease with option to purchase plan available. Integral 103-compatible modems can be purchased at an added cost to the terminal for $300-350, an amount equal to one year's Bell rental. Prices of free-standing 103 modems vary in the range of $400 to $500.

Improvements in reliability are gained with integral modems. The interconnection scheme is simpler and is controlled by the terminal manufacturer. No redundant power supplies are required. Since an RS232 interface is not required between terminal and modem, interface circuitry is less complex. Furthermore, when maintenance is required, integral modems obviate the necessity of working through a separate vendor's field service organization; MTTR times are negligible in that "card swapping" is employed to repair a malfunctioning modem.

Packaging the modem inside the terminal also provides for less complicated operating procedures. Operators have one less "box" to be concerned about and fewer switches, etc. to work. The value placed on floor space in a given installation and the aesthetics of a streamlined system package weigh in the favor of integral modems as well.

Integral modems have recently been described as the "wave of the future"; reviewing the factors outlined above makes it easy to understand why. ▲

possible and will be used more frequently in future computer communications systems because of the usefulness of batch terminals that operate in the range of 1.2 to 4.8 kbps. A medium-speed system that can multiplex eight channels at 1200 bps onto one line via a 9600 bps modem will be examined in more detail.

The high-speed side of the system interfaces the phone line through a 9600 bps modem that uses automatic and adaptive equalization, while the medium-speed side of the system offers an RS 232 interface for direct digital connection to communication subsystems, and also to 1200, 1800, 2400, and 4800 bps modems. Access to the medium-speed modems can be from terminals or remote computers that are either on dedicated lines or on dial access circuits.

The multiplexer is transparent to the terminals so that existing facilities can be multiplexed without requiring any modification to the hardware and software of the previous arrangement. The control signals on the RS 232 interface are passed from end to end using the normal data channel during time slots when the channel is not transmitting data.

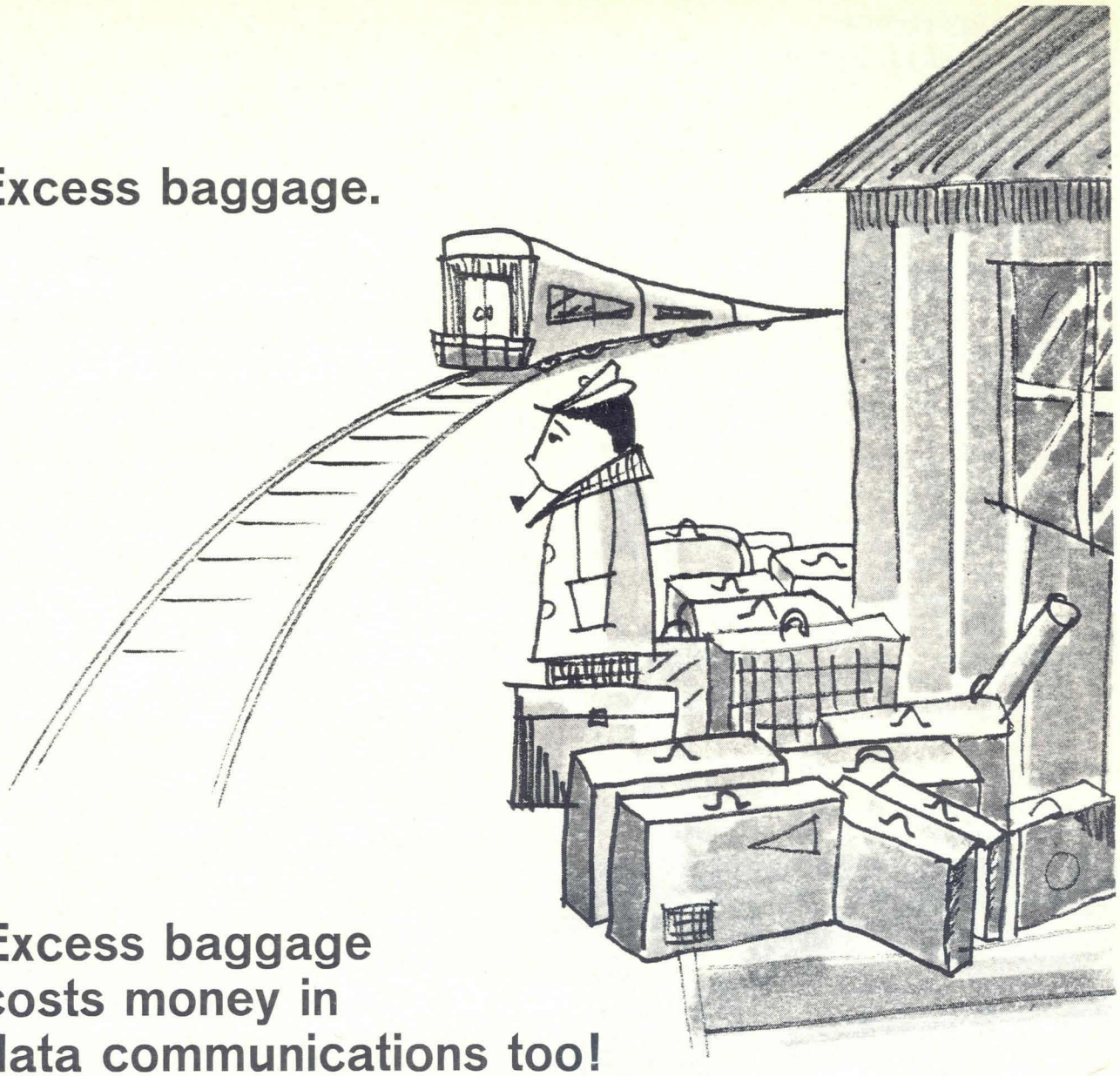
Trouble in a communication system might take on one of two characteristics: reduced performance due to line or component degradation, or inability to communicate due to circuit or component failure.

In TDM, it it is possible to limp along until the degradation problem is solved by shifting to a lower transmission rate. A switch on the multiplexer can shift the speed from 9600 to 7200 and 4800 bps, and there is a patch panel that selects those circuits allowed to remain on-line during speed shifted operation.

Line degradation in FDM usually shows up as poor response in the edge (outside) channels of the frequency band. The center channels can still operate satisfactorily, and in case of priority, the important channels can be moved to the inside, while the edge channels are temporarily dropped. Where a total failure occurs, one must know quickly if the fault lies with the computer, the multiplexer, the dataset, the circuit, or the terminal. A quick way to determine the location of the failure is through loopback circuit capability and systems diagnostics. Loopback circuits cut the modem out of the circuit by turning around its analog and digital interfaces, and cut the multiplexer out by turning the receive module around to the transmit module.

Continued on Page 70 .....

Excess baggage.



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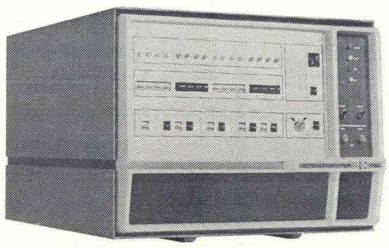

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CIRCLE NO. 31 ON INQUIRY CARD

Concentration

A concentrated circuit configuration is one in which there are more terminals having access to the computer than there are ports on the computer to service them. The object behind concentration is the conservation of telephone line costs, better utilization of channel capacity, and reduction in the number of computer entry ports. System efficiency and economics depend heavily on these items.

In a concentrated circuit system, each terminal operates in contention, or contends for system access with the other terminals that are liable to be using all the computer ports at the time that it wishes to do so. If the system is multipoint (having more than two drops) the local terminal users in one area must contend with the users in the other local areas as well as among themselves. At the computer port it is also possible to run in a contention mode.

Assume that two remote concentrators with three ports apiece are connected to a multipoint circuit that demultiplexes into three computer ports. If the configuration has two remote users on concentrator 1, and one remote user on concentrator 2, then all three computer ports would be occupied. At that point in time, the concentrator is acting as a multiplexer and is interleaving data from the three connected remote terminals.

In actuality then, an ideal system for specific applications can be designed by using devices that are combinations of concentrators and multiplexers. As a result, a number of high priority, or high traffic, terminals can have access at any time through their private, reserved channel, while the low priority and minimal users may contend for access to the computer.

THE FUTURE

There are many independent manufacturers of modems and multiplexers. This desirable situation provides competition, which results in low prices and high reliability. Many of these companies are small and/or new, and although they deserve credit for their inventiveness and a chance to prove their performance, the user must make sure that a system designed around the hardware of a small independent can be adequately supported and serviced.

In the future, the user will become more involved in the selection of multiplexers and less involved in the selection of modems. Modems will lose their identity. The modulating and demodulating functions will be built into the terminals, allowing them to connect to the telephone network through the phone company's direct access arrangement.

The choice of multiplexers will become more complicated because the network will require sophisticated, programmable multiplexing. In the total system, hardware multiplexing (as described in this article) will still be used for low performance terminal clusters in order to save telephone line costs; computerized multiplexers will be used at higher level network nodes for improving total system efficiency.

THE TABLES

Tables 1 and 2 present the characteristics of modems and multiplexers employed in the transmission of computer data over analog lines. Further information on specific units may be obtained by referencing Tables 3 and 4, and using the Reader Service Card.

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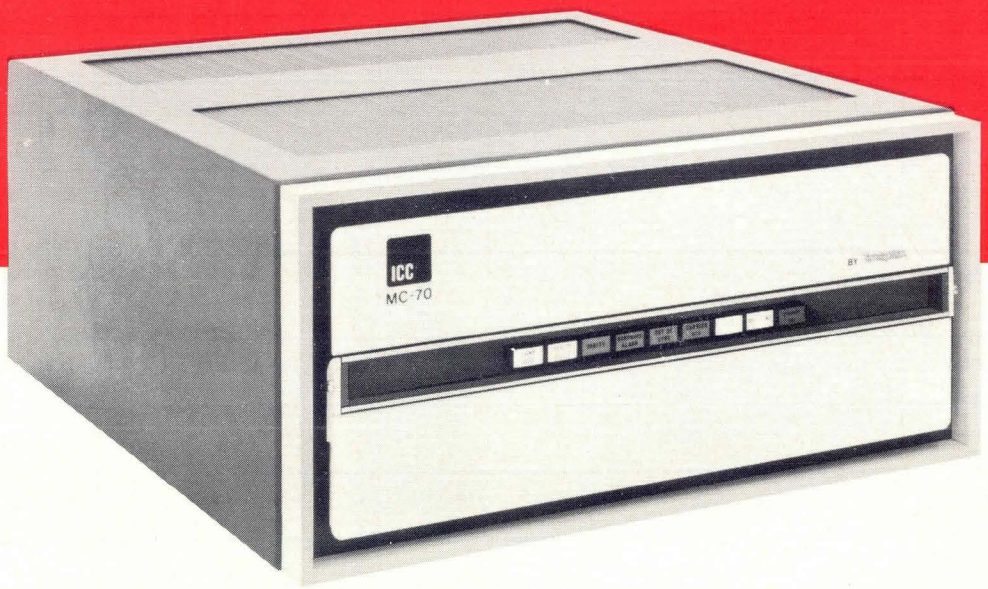

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CIRCLE NO. 35 ON INQUIRY CARD

TABLE 1 • MODEMS

Manufacturer	Model	Data Format	Data Rate Line Condition	Operating Mode	Modulation Technique	Figure Merit	Error Rate	Compatibility	Price	Other Features
American Data Systems	ADS-448	Serial Sync.	1200/2000/2400/4800 bps UC; C1; C2; C4	Simplex H.Dup.-2/4W F.Dup.-2/4W	PM	2.3	10^{-7}	—	$6,000	Data rates may be intermixed
Astrocom	120	Serial Async.	1200 bps-UC 1800 bps-C2	Simplex H.Dup.-2/4W F.Dup.-4W	FM	1	10^{-6}	WE 202C/D/E	—	
	130	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	1	10^{-6}	WE 103A/E/F	—	
	200	Serial Sync.	2000/2400/3600/4800/ 7200/9600 bps-UC	Simplex H.Dup.-2/4W F.Dup.-2/4W	PM	1	10^{-7}	—	—	On 22 ga. cable, ranges are 13 miles (2000 bps) to 5 miles (9600 bps)
	400	Serial Sync.	10/19.2/40.8/50/72/ 96 Kbps-UC	Simplex H.Dup.-2/4W F.Dup.-4W	PSK	1	10^{-7}	—	—	On 22 ga. cable, ranges are 5 miles (10 Kbps) to 2 miles (96 Kbps)
Bowmar/Ali	6000A	Serial Sync.	1200/2400 bps-UC	H.Dup.-2W	PM	1.8	10^{-4}	—	—	
	6103	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	1	10^{-6}	WE 103A/E/F	—	
	6202A	Serial Async.	1200 bps-UC	F.Dup.-4W	PM	2	10^{-8}	—	—	
Burroughs	TA 713	Serial Async.	1200 bps-UC	H.Dup.-4W F.Dup.-4W	FSK	1	10^{-5}	WE 202D	$600	Equivalent models TA 211 & TA 212 are available for BUR TC 500/700
	TA 783	Serial Async.	1800 bps-UC	H.Dup.-4W F.Dup.-4W	FSK	1	10^{-5}	WE 202D	—	Equivalent model TA 282 is available in Parallel-Sync. format
Carterfone Communications	DM 318 DM 328	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	0.5	—	WE 103 Originate	$410	
	DM 319 DM 329	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	0.5	—	WE 103A Answer	$495	
	MB 132	Serial Async.	440 bps-UC	F.Dup.-2/4W	FSK	0.5	—	WE 103A/E Answer	$600	
Codex	4800	Serial Sync.	4800 bps-UC	Simplex H.Dup.2/4W F.Dup.-2/4W	Combination PM & AM	3	10^{-6}	—	$5,575	
	AE-96	Serial Sync.	4800 bps-UC 9600 bps-C2	Simplex H.Dup.-2/4W F.Dup.-2/4W	AM (SSB)	4	10^{-5}	—	$11,500	
Collins Radio	TMX-202G	Serial Async.	1800 bps-UC	Simplex H.Dup.-2/4W F.Dup.-2/4W	FSK	1	—	WE 202C/D	$835	
	TE-236	Serial Sync.	2400 bps-UC	F.Dup.-2/4W	PSK	2	10^{-5}	WE 201B	$2,000	
	TE-216A-4D	Serial Sync.	2400/4800 bps-C4	F.Dup.-4W	PSK	1	10^{-6}	—	$6,300	
ComData	301F	Serial Async.	300 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	—	—	WE 103	$295	
Communications Logic	Low Speed	Serial Async.	300 bps-UC	H.Dup.-2W F.Dup.-4W	FSK	1	10^{-5}	WE 103	$269	
	L-1200	Serial Sync.	1200 bps-UC	H.Dup.-2W F.Dup.-4W	PM	0.5	10^{-5}	—	$495	
	L-1800	Serial Async.	1800 bps-UC	H.Dup.-2W F.Dup.-4W	FSK	0.5	10^{-5}	WE 202C/D	$450	
	L-2400	Serial Sync.	2400 bps-C2	H.Dup.-2W F.Dup.-4W	PM (4-phase)	1	10^{-5}	WE 201B	$1,685	

TABLE 1 • MODEMS .....Cont'd

Manufacturer	Model	Data Format	Data Rate Line Condition	Operating Mode	Modulation Technique	Figure Merit	Error Rate	Compatibility	Price	Other Features
Computer Transmission	915	Serial Sync.	1200 to 20,000 bps Private Line	F.Dup.-4W	Pulse Code	—	10^{-8}	—	$1,875	
	916	Serial Sync.	10 to 250 Kbps Private Line	F.Dup.-4W	Pulse Code	—	10^{-8}	—	$1,925	
Credex	1103	Serial Async.	150 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	—	—	WE 103	$119	
	3300 3301 3305	Serial Async.	300 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	—	—	WE 103	$475 $350 $370	3300 — Originate only w. auto dialer 3301 — Originate only 3305 — Answer only
Datamax	QB 24	Serial/Parall. Sync.	2400 bps-C2	H.Dup.-4W F.Dup.-4W	AM (VSB)	2.6	10^{-7}	—	$3,300	
	QB 48	Serial/Parall. Sync.	4800 bps-C2	H.Dup.-4W F.Dup.-4W	AM (VSB)	4	10^{-7}	—	$8,160	
Data Products — Telecommunications	703	Serial Async.	300 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	0.9	10^{-6}	WE 103A/F	—	
	802	Serial Sync./Async.	1200 bps-UC 1800 bps-C2	H.Dup.-2W F.Dup.-2/4W	FSK	0.9	10^{-6}	WE 202C/D	—	
	901	Serial Sync.	1200/2400 bps-UC	H.Dup.-2W F.Dup.-4W	AM (VSB)	2.0	10^{-6}	—	—	
Ford Industries	1210 1610	Serial Async.	300 baud-UC	Simplex H.Dup.-2/4W F.Dup.-2/4W	FSK	—	10^{-6}	WE 101C WE 103A/E/F	—	
General DataComm Industries	103	Serial Async.	300 bps-UC	F.Dup.-2/4W	FSK	—	—	WE 103A/E/F	$360	
	202	Serial Async.	1200 bps-UC 1800 bps-C2	Simplex H.Dup.-2W F.Dup.-4W	FSK	—	—	WE 202	$490	
	402C	Parallel Sync.	600 bps-UC	Simplex H.Dup.-2W F.Dup.-4W	FSK	—	—	WE 402C	$440	
General Dynamics — Electronics Div.	1402	Serial Async.	600/1200 bps-UC	Simplex H.Dup.-2/4W F.Dup.-4W	FSK	—	—	—	—	
	1403	Serial Sync.	4800 bps-C1	H.Dup.-2/4W F.Dup.-4W	AM (VSB)	—	—	—	—	
General Electric — Communications Products Dept.	TDM-110	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	—	—	WE 103F	$645	TDM 112, 113 models for integral mounting
	TDM-111	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	—	—	WE 103A2/E	$750	
	TDM-210	Serial Async.	1000 bps-UC 1200 bps-C1 1800 bps-C2	H.Dup.-2W F.Dup.-4W	FSK	—	—	WE 202D	$840	
	TDM-211	Serial Async.	1200 bps-UC	H.Dup.-2W	FSK	—	—	WE 202C	$980	
	TDM-220	Serial Async.	2400 bps-C2	H.Dup.-2W F.Dup.-4W	AM (VSB)	—	—	—	$1,020	
	TDM-330	Serial Sync.	2400/4800/9600 bps Cable Pair	F.Dup.-4W	PM (diphase)	—	—	—	$925	
	Digi Net 400	Serial Sync./Async.	to 50K bps Cable	F.Dup.-4W	AM (VSB)	—	—	—	$3,100	
	Digi Net 500	Serial Sync./Async.	to 250K bps Cable	F.Dup.-4W	AM (VSB)	—	—	—	$3,100	

TABLE 1 • MODEMS .....Cont'd

Manufacturer	Model	Data Format	Data Rate Line Condition	Operating Mode	Modulation Technique	Figure Merit	Error Rate	Compatibility	Price	Other Features
IBM — Federal Systems Div.	4872	Serial Async.	4800 bps-C2	F.Dup.	AM (SSB)	2	10^{-6}	—	$4,460	
Intertel	IN 103	Serial Async.	300 baud-UC	Simplex H.Dup.-2W F.Dup.-2W	FSK	0.3	10^{-5}	WE 103A/F	$125 (OEM)	Integral modems
	IN 202	Serial Async.	1200 baud-UC 1400 baud-C1 1800 baud-C2	Simplex H.Dup.-2W F.Dup.-4W	FSK	0.8	10^{-5}	WE 202C/D	$210 (OEM)	
I/Onex Div. Sonex	300	Serial Async.	300 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	1	10^{-7}	WE 103A/E	$2,350*	*For 8 channels
Lenkurt Electric	26C	Serial Sync./Async.	150/300/600/1200 /2400 bps-UC; C1	Simplex H.Dup.-4W F.Dup.-4W	FM	2	10^{-6}	—	—	
	26D	Serial Async.	4800 bps +150 bps C2	Simplex H.Dup.-4W F.Dup.-4W	FM	2	10^{-6}	—	—	
Lynch Communications	L 2103A/F	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	—	—	WE 103A/F	—	
Milgo-ICC	300	Serial Async.	300 bps-UC	Simplex H.Dup.-2W F.Dup.-2W	FSK	—	—	WE 103	(OEM)	
	1100	Serial Sync.	4.8 to 1000K bps Solid Conductor	F.Dup.-4W	PM (diphase)	—	—	—	—	
	2200/20	Serial Sync.	2000 bps-UC	Simplex H.Dup.-2/4W F.Dup.-4W	PM (4-phase)	2	—	WE 201A	$2,450	
	2200/24	Serial Sync.	1200/2400 bps UC	Simplex H.Dup.-2/4W F.Dup.-4W	PM (4-phase)	2	—	WE 201B	$2,450	
	3300/36	Serial Sync./Async.	3600 bps (Sync.) & 150 bps (Async.)-UC	Simplex H.Dup.-2/4W F.Dup.-2/4W	AM & PM FSK (150 bps)	3	—	—	$3,620	
	4400/24PB	Serial Sync.	2400 bps-UC	Simplex H.Dup.-2/4W F.Dup.-4W	PM (8-phase)	3	—	—	$5,050	
	4433/20	Serial Sync.	2000 bps-UC	Simplex H.Dup.-4W F.Dup.-4W	AM & PM (4-phase)	3	—	—	$5,250	
	4400/48	Serial Sync.	4800 bps-UC	Simplex H.Dup.-2/4W F.Dup.-4W	PM (8-phase)	3	—	—	$5,885	
	5500/96	Serial Sync.	9600 bps-C2	F.Dup.-4W	AM (VSB)	4	—	—	$11,500	
Paradyne	MARQ-48	Serial Sync.	5112 bps-UC	Simplex H.Dup.-2/4W F.Dup.-4W	AM (VSB)	2	10^{-12}	—	$5,950	
Penril Data Communications	TTY-300 300/300	Serial Async.	300 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	1	10^{-6}	WE 101C, 103A/E WE 103A/E/F	$400 $325	
	1200/5	Serial Async.	1200 bps (forward), 5 bps (reverse)-UC	H.Dup.-2W	FSK	1	10^{-6}	WE 202C6	$400	
	1800B	Serial Async.	1200 bps-UC 1800 bps-C2	H.Dup.-2W F.Dup.-4W	FSK	1.1	10^{-6}	WE 202D	$360	
	2400A	Serial Sync.	2400 bps-UC	H.Dup.-2W F.Dup.-4W	AM (VSB)	4	10^{-6}	—	$1,450	
	2400B	Serial Sync.	2400 bps-C2	H.Dup.-2W F.Dup.-4W	AM (VSB)	1.5	10^{-6}	—	$1,100	
	2400B-1	Serial Sync.	2400 bps-UC	H.Dup.-2W F.Dup.-4W	PM (4-phase)	2.2	10^{-6}	WE 201B	$1,650	
	4800B	Serial Sync.	4800 bps-C2	H.Dup.-4W F.Dup.-4W	AM (VSB)	4.4	10^{-6}	—	$3,500	

TABLE 1 • MODEMS ..... Cont'd

Manufacturer	Model	Data Format	Data Rate Line Condition	Operating Mode	Modulation Technique	Figure Merit	Error Rate	Compatibility	Price	Other Features
Philco-Ford	MC-12/24-2B	Serial Sync.	300/600/1200/2400 bps 3 kHz Lines	Full Duplex	PSK	—	—	—	—	
	MC-48	Serial Sync.	300/600/1200/2400/ 4800 bps-3 kHz Lines	Full Duplex	PSK	—	—	—	—	Data rates may be intermixed.
	MC-96	Serial Sync.	1200/2400/4800/7200/ 9600/14400 bps-C2	—	AM (SSB)	—	—	—	—	
Pulsecom	4000	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	1	10^{-5}	WE 103	—	
RCA — Commercial Communications	CDS-1200	Serial Async.	1200 bps-UC 1800 bps-C2	Simplex H.Dup.-2/4W F.Dup.-2/4W	FSK	—	—	WE 202D	$800	
RFL Industries	13AO	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	1	10^{-5}	WE 103A/F	$350	
	22DB/EIA	Serial Async.	1200 bps-UC	H.Dup.-2W F.Dup.-4W	FSK	1	10^{-5}	WE 202D	$941	
	3952	Serial Sync.	2400 bps-UC	H.Dup.-2W F.Dup.-4W	PM (4-phase)	1	10^{-5}	WE 201D	$2,400	
	4604	Serial Sync.	2000 bps-UC	H.Dup.-2W F.Dup.-4W	PM (4-phase)	1	10^{-5}	WE 201A	$2,100	
Sanders Assoc. Electro-Sciences Div.	123 312	Serial Async.	1200 + 150 bps UC	F.Dup.-2W	FSK	1	10^{-5}	—	—	
	Pack 18A	Serial Async.	1200 bps-UC 1800 bps-C1	Simplex H.Dup.-2/4W F.Dup.-4W	FSK	1	10^{-6}	WE 202C/D	—	Also available as circuit Card 18A for integral use
Sangamo Electric	T 103	Serial Async.	300 bps-UC	F.Dup.-2W	FM	—	—	WE 103A/F	$483	
	T 201A	Serial Sync.	2000 bps-UC	H.Dup.-2/4W F.Dup.-2/4W	PM	—	—	WE 201A	$2,075	
	T 201B	Serial Sync.	2400 bps-C2	H.Dup.-2/4W F.Dup.-2/4W	PM	—	—	WE 201B	$2,158	
	T 202C T 202D	Serial Async.	1200/1800 bps-UC	H.Dup.-2/4W F.Dup.-2/4W	FM	—	—	WE 202	$740	
Singer — TeleSignal Div.	883A 883F	Serial Async.	300 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	1	10^{-5}	WE 103A/F	$418	
	883R	Serial Sync./Async.	1200/2400 bps-UC	H.Dup.-2W F.Dup.-4W	AM (VSB)	2	10^{-5}	—	$825	
	898A 898C	Serial Async.	600/1200 bps-UC 1800 bpsC2	H.Dup.-2W F.Dup.-4W	FSK	1	10^{-5}	WE 202C/D	$575	
Teledynamics Div. AMBAC	7103	Serial Async.	300 baud-UC	F.Dup.-2W	FSK	—	—	WE 103	—	
	7104	Serial Async.	1200 baud-UC	H.Dup.-2W F.Dup.-4W	FSK	—	—	WE 202C	—	
	7260	Serial/Parall. Sync./Async.	75/150/300/600/1200 baud-UC	F.Dup.-4W	FSK	—	—	—	—	Handles up to 8 channels
Tel-Tech	TT 103	Serial Async.	300 bps-UC	Simplex H.Dup.-2W F.Dup.-2W	FSK	1	—	WE 103	$390	Circuit card model available at $199
	TT 201-B	Serial Sync.	2400 bps-C2	Simplex H.Dup.-2/4W F.Dup.-4W	PM	2	—	WE 201B	$1,495	Circuit card model available at $1,345
	TT 202	Serial Sync./Async.	1200 bps-UC 1800 bps-C2	Simplex H.Dup.-2/4W F.Dup.-4W	FSK	1	—	WE 202	$515	Circuit card model available at $310

TABLE 1 • MODEMS . . . . . Cont'd

Manufacturer	Model	Data Format	Data Rate Line Condition	Operating Mode	Modulation Technique	Figure Merit	Error Rate	Compatibility	Price	Other Features
Tuck Electronics	1157/1158	Serial Async.	300 bps-UC	H.Dup.-2/4W F.Dup.-2/4W	FSK	—	10^{-9}	WE 101, 103A/E/ F/G/H, 105, 113A/B	$200	Integral Card Modems
	1042AA & AP	Serial Sync.	300 bps-UC	H.Dup.-2W F.Dup.-2W	FSK	—	10^{-9}	WE 101, 103A/E/ F/G/H, 105, 113A	$400	Mounts in TTY/IBM 2741
	1098	Serial Sync./Async.	40.8K bps-8 pair Twisted wire	H.Dup. F.Dup.	—	—	10^{-9}	—	$800	
Ultronic Systems	300	Serial Async.	300 bps-UC	Simplex H.Dup.-2W F. Dup.-2W	FSK	—	10^{-6}	WE 103A/E/F	$350	
	1200	Serial Async.	1200 bps-UC 1400 bps-C1	Simplex H.Dup.-2/4W F.Dup.-4W	FSK	—	10^{-6}	WE 202C/D	$499	
	2400	Serial Sync.	2400 bps-UC	Simplex H.Dup.-4W F.Dup.-4W	FSK	2	10^{-6}	—	$1,851	
	4800	Serial Sync.	4800 bps-C2	Simplex H.Dup.-2W F.Dup.-4W	AM (SSB)	2	10^{-6}	—	$3,175	
United Business Communications — Rixon	DS 1800	Serial Async.	1200 bps-UC 1800 bps-C2	Simplex H.Dup.-2/4W F.Dup.-4W	FSK	1	10^{-6}	WE 202C/D	$755	
	DS 2400	Serial Sync.	1200/2400 bps UC; C1	Simplex H.Dup.-2/4W F.Dup.-4W	PM (4-phase)	1.3	10^{-5}	WE 201B	—	
	DS 4800	Serial Sync.	4800 bps-C2	Simplex H.Dup.-2/4W F.Dup.-4W	PM (8-phase)	2.7	10^{-5}	—	$5,650	
	DS 7200	Serial Sync.	3600/4800/7200 bps C2	Simplex H.Dup.-2/4W F.Dup.-4W	AM (VSB)	4	10^{-5}	—	$9,950	
	DS 9600	Serial Sync.	4800/6400/9600 bps C2	Simplex H.Dup.-2/4W F.Dup.-4W	AM (VSB)	5.3	10^{-5}	—	$11,500	
Vadic	VA 300 VA 300M	Serial Async.	300 bps-UC	Simplex H.Dup.-2W F.Dup.-2W	FSK	1	—	WE 103A/E/F	$175	
	VA 1200	Serial Async.	1200 bps-UC 1800 bps-C2	Simplex H.Dup.-2W F.Dup.-4W	FM	1	—	WE 202C/D/E	$250	
Western Telematic	CL 103	Serial Async.	300 bps-UC	F.Dup.-2W	FSK	0.6	10^{-7}	WE 103A/F	—	Miniature construction for integral use
	CL 202	Serial Async.	1200 bps-UC 1800 bps-C3	H.Dup.-2W F.Dup.-4W	FSK	0.8	—	WE 202	—	

TABLE 2 • MULTIPLEXERS

Manufacturer	Model	Multiplexing	No. Inputs & Input Data Rates	Transmission Rates & Line Condition	Intermixing	Operation	Price
American Data Systems	ADS-630	TDM-bit	18 @ 75/110; 14 @ 134.5; 12 @ 150; 4 @ 300 bauds — async.	2400 bps-UC	Any Two Input Rates	Multi-Point & Concentration	$2,750 (basic per end)
	ADS-660	TDM-char.	45 @ 75/110; 36 @ 134.5/150; 18 @ 300 bauds — async.	4800 bps-UC	Any Three Input Rates	Multi-Point	$5,000 (basic per end)
Codex	TM-8	TDM-bit	8 @ 1200/2400/4800 bps sync./async.	9600 bps-C2	Any Three Input Rates	Concentration	$3,500 (basic per end) $250 (per input)
			4 @ 1200/2400/4800 bps sync./async.	4800 bps-UC			
	800	TDM-char.			—	Multi-Point & Concentration	$400 (per input)
Collins Radio	TMX-201	FDM	22 @ 75; 16 @ 110; 7 @ 150 bps — async.	C1	110 & 150 bps	Multi-Point	—
			20 @ 75; 14 @ 110; 6 @ 150 bps — async.	UC			
	TMX-202D	FDM	9 @ 200 bps — async.	C2	110 with 200 bps available	Multi-Point	$735 (per end) $735 (per add-on)
			7 @ 200 bps — async.	UC			
ComData	200	FDM	18 @ 110; 12 @ 150; 6 @ 300; 1 @ 600 bps — async.	—	Any Input Rates	Multi-Point & Concentration	$415 (per end) $305 (per input)
Communications Logic	SMV	TDM-bit	4 @ 2400; 2 @ 4800 bps	4800/7200/9600 bps	—	Concentration	—
	TDMLV	TDM-bit	18 @ 110/134.5/150 baud	2400 bps-C4	Any Input Rates	Multi-Point & Concentration	—
	TDMRX	TDM-bit	27 @ 110 baud	2400 bps	—	Multi-Point & Concentration	—
	TDMT	TDM-bit	8 @ 75/110/134.5/150 bps	1200 bps	—	Multi-Point	$2,995 (per end)
Computer Transmission	Multitran	TDM-bit	Up to 2 Mbps Output Trunk Dependent	2 Mbps (max) 4W Cable	Any Input Rates	Multi-Point	$3,500 (per end)
Data Products — Telecommunications	DataPak	FDM	25 @ 75; 18 @ 110; 12 @ 150; 6 @ 300; 2 @ 600; 1 @ 1200/1800 bps	C4	Any Input Rates	Multi-Point & Concentration	—
			18 @ 75; 13 @ 110; 9 @ 150; 5 @ 300; 1 @ 600 bps	UC			
General DataComm Industries	TDM-1201	TDM-char.	112 max. — Any Input from 37.5 to 2,400 baud — async.	0.6 to 40.8 Kbps	Any Input Rates	Multi-Point & Concentration	$2,000 (per end)
General Dynamics — Electronics Div.	EDX-1701	TDM-char.	240 max. — 75/150/300/600/ 1200/2400/4800 bps — async.	—	—	—	—
General Electric — Communications Products Dept.	DigiNet 150 & DigiNet 160	FDM	17 @ 110; 12 @ 150; 6 @ 300 bps — async.	C4	Any Input Rates	Multi-Point	—
			12 @ 110; 9 @ 150; 4 @ 300 bps — async.	UC			
	DigiNet 1600	FDM	60 max. — 110/134.5/150/ 300 bps — async.	600/1200/2400/4800/ 9600 bps — 4 max.	Any Input Rates	Multi-Point & Concentration	—
Infotron	220	TDM-bit/char.	88 @ 75; 56 @ 110; 43 @ 134.5; 38 @ 150; 18 @ 300 bps — async.	4800 bps	Any Four Input Rates	Multi-Point	$4,500 (per end)
			22 @ 75; 13 @ 110; 10 @ 134.5; 8 @ 150; 3 @ 300 bps — async.	1200 bps			$90 (per input)
I/Onex Div. Sonex	100	TDM-bit	72 @ 110; 60 @ 135; 56 @ 150; 28 @ 300 bps — async.	9600 bps	Any Input Rates	Multi-Point & Concentration	$4,400 (per end)
			8 @ 110; 8 @ 135; 8 @ 150 bps — async.	UC			$175 (per input)

TABLE 2 • MULTIPLEXERS ..... Cont'd

Manufacturer	Model	Multiplexing	No. Inputs & Input Data Rates	Transmission Rates & Line Condition	Intermixing	Operation	Price
Lenkurt Electric	25B	FDM	25 @ 75; 18 @ 110; 12 @ 150; 8 @ 200; 1 @ 600 bps — async.	UC	Any Input Rates	Multi-Point	—
Lynch Communications Systems	B313	TDM-bit	4 @ 64; 1 @ 256 Kbps — sync.	Repeater Lines	—	Multi-Point	—
	B317	TDM-bit	168 max. — 200/300/400/600/800 bps — sync.	1.5 Mbps — Repeater Lines	—	Multi-Point	—
Milgo-ICC	MC-70	TDM-char.	70 max. — 45 to 1200 bps — async.	9600 bps-UC	Any Three Input Rates	Multi-Point	$6,000 (per end w. 23 inputs)
On-Line Computer	1284	TDM-char.	128 max. — 45 to 1800 bps — async.	1200/1800/2400/3600/4800/7200/9600 bps 4 max.	Any Input Rates	Multi-Point	$22,000 (per end w. 32 inputs)
Philco-Ford	FS-96C	TDM-char.	15 max. — 75/150/300/1200/2400 bps — async.	1200/2400/4800 bps	Any Input Rates	—	—
RCA — Commercial Communications	CDM	FDM	24 @ 75; 18 @ 110; 12 @ 150 bps — async.	UC	None	—	—
RFL Industries	2056	FDM	22 @ 75; 16 @ 110; 11 @ 150; 7 @ 200; 4 @ 300; 2 @ 600 bps — async.	UC	Any Input Rates	Multi-Point	—
Singer — TeleSignal Div.	2394	FDM	18 @ 110 bps — async.	UC	—	—	—
	2450	FDM	24 @ 75 bps — async.	UC	—	—	—
	2503	FDM	12 @ 150 bps — async.	UC	—	—	—
	2533	TDM-char.	77 @ 75; 52 @ 110; 39 @ 134.5/150 bps — async.	4800 bps	—	—	—
			19 @ 75; 13 @ 110; 9 @ 134.5/150 bps — async.	1200 bps			
Tel-Tech	TTC-1000	TDM-bit	38 @ 110; 30 @ 134.5; 28 @ 150; 14 @ 300 bps — async.	C2	Any Input Rates	Multi-Point & Concentration	—
	TTC-2000 & 3000	TDM-bit	76 @ 110; 60 @ 134.5; 56 @ 150 bps — async.	9600 bps-C2	Any Input Rates	Multi-Point & Concentration	—
			12 @ 110; 10 @ 134.5; 8 @ 150; 4 @ 300 bps — async.	1800 bps-C2			
Timeplex	MC-70	TDM-char.	71 @ 50/75; 67 @ 110; 52 @ 134.5; 44 @ 150; 24 @ 300; 10 @ 600 bps — async.	4800 bps	Any Three Input Rates	Multi-Point & Concentration	$5,950 (per end w. 23 inputs)
	SMC-200 & 300	TDM-bit	132 max. — 1200/2400 bps — sync.	500 Kbps	—	Multi-Point	—
Tuck Electronics	—	FDM	11 @ 150 baud — async.	UC	—	Multi-Point	$280 (per input)
Ultronic Systems	8000	FDM	25 @ 75; 18 @ 110; 12 @ 150; 7 @ 200 baud — async.	C4	Any Input Rates	Multi-Point & Concentration	$700 (per end)
	9520	TDM-char.	20 max. — 50/75/100/110/134.5/150/300/600/1200 bps — async.	1200/2400/3600/4800/7200/9600 bps-C2/C4	Any Four Input Rates	Multi-Point	$4,165 (per end) $185 (per input)
United Business Communications — Rixon	TDX-1	TDM-bit	24 @ 110/135/150 bps — async.	2970 bps-C2	None	Multi-Point	—
	TDX-2	TDM-char.	88 @ 110; 59 @ 135/150 bps — async.	9600 bps-C2	Any Input Rates	Multi-Point	—
Xerox Data Systems	7640	TDM-char.	32 @ 45/110 bps — async.	1200 to 9600 bps	—	—	$8,200

MORE MODEMS . . .

Modex of Costa Mesa, Cal., and **National Midco Industries of Trenton, N.J.** have recently announced modem products. **Modex's** Series X202 FSK modems, available in standalone chassis or integral configurations, utilize MOS-LSI techniques to provide 1200 bps unconditioned, or 1800 bps conditioned operation. **National Midco Industries'** ADC 300 FM integral modem operates at 300 baud rates and is available from stock at $145.

TABLE 3 • REFERENCE LITERATURE

For additional information on ***Modems*** *described in Table 1, circle the appropriate numbers listed below on the Reader Service Card.*

Company	Reader Service Card Number
American Data Systems, Chatsworth, Cal.	249
Astrocom, St. Paul, Minn.	250
Bowmar/Ali, Acton, Mass.	251
Burroughs, Detroit, Mich.	252
Carterfone Communications, Dallas, Texas	253
Codex, Watertown, Mass.	254
Collins Radio, Newport Beach, Cal.	255
ComData, Niles, Ill.	256
Communications Logic, Houston, Texas	257
Computer Transmission, Los Angeles, Cal.	258
Credex, Huntsville, Ala.	259
Datamax, Ann Arbor, Mich.	260
Data Products-Telecommunications, Stamford, Conn.	261
Ford Industries, Portland, Ore.	262
General DataComm Industries, Norwalk, Conn.	263
General Dynamics, Orlando, Fla.	264
General Electric, Lynchburg, Va.	265
IBM, Gaithersburg, Md.	266
Intertel, Burlington, Mass.	267
I/Onex, Philadelphia, Pa.	268
Lenkurt Electric, San Carlos, Cal.	269
Lynch Communications, San Francisco, Cal.	270
Milgo-ICC, Miami, Fla.	271
Modex, Costa Mesa, Cal.	272
National Midco Industries, Trenton, N.J.	273
Paradyne, Rockville, Md.	274
Penril Data Communications, Rockville, Md.	275
Philco-Ford, Willow Grove, Pa.	276
Pulsecom, Falls Church, Va.	277
RCA — Communications, Camden, N.J.	278
RFL Industries, Boonton, N.J.	279
Sanders Associates, Nashua, N.H.	280
Sangamo Electric, Springfield, Ill.	281
Singer-TeleSignal, Woodbury, N.Y.	282
Teledynamics, Ft. Washington, Pa.	283
Tel-Tech, Rockville, Md.	284
Tuck Electronics, New Cumberland, Pa.	285
Ultronic Systems, Moorestown, N.J.	286
United Business Communications, Shawnee Mission, Kan.	287
Vadic, Palo Alto, Cal.	288
Western Telematic, Arcadia, Cal.	289

TABLE 4 • REFERENCE LITERATURE

For additional information on ***Multiplexers*** *described in Table 2, circle the appropriate numbers listed below on the Reader Service Card.*

Company	Reader Service Card Number
American Data Systems, Chatsworth, Cal.	290
Codex, Watertown, Mass.	291
Collins Radio, Newport Beach, Cal.	292
ComData, Niles, Ill.	293
Communications Logic, Houston, Texas	294
Computer Transmission, Los Angeles, Cal.	295
Data Products-Telecommunications, Stamford, Conn.	296
General DataComm Industries, Norwalk, Conn.	297
General Dynamics, Orlando, Fla.	298
General Electric, Lynchburg, Va.	299
Infotron, Pennsauken, N.J.	300
I/Onex, Philadelphia, Pa.	301
Lenkurt Electric, San Carlos, Cal.	302
Lynch Communications Systems, San Francisco, Cal.	303
Milgo-ICC, Miami, Fla.	304
On-Line Computer, Stamford, Conn.	305
Philco-Ford, Willow Grove, Pa.	306
RCA-Communications, Camden, N.J.	307
RFL Industries, Boonton, N.J.	308
Singer-TeleSignal, Woodbury, N.Y.	309
Tel-Tech, Rockville, Md.	310
Timeplex, Norwood, N.J.	311
Tuck Electronics, New Cumberland, Pa.	312
Ultronic Systems, Moorestown, N.J.	313
United Business Communications, Shawnee Mission, Kan.	314
Xerox Data Systems, Los Angeles, Cal.	315

AND IN THIS CORNER . . . RCA

RCA's New Computers: Some Initial Reactions

EDITOR'S NOTE: *The following comments refer to the new family of RCA computers — the RCA 2, 3, 6, and 7. This family is meant to be competitive with the existing 3rd generation market . . . the IBM 360/30, 40, and 50 . . . and is software compatible with IBM 360/370 source language.*

BASIC FEATURES OF RCA'S FAMILY

RCA 2 — A small-to-medium scale real-memory computer with memory sizes ranging from 65 to 262K bytes. A typical RCA 2 with a 131,072 byte memory will rent for $15,400 and may be purchased for $700,000.

RCA 3 — A small-to-medium scale virtual-memory computer with main memory ranging from 131 to 262K bytes, and a virtual memory of up to 2M bytes. A typical system with 131,072 bytes will rent at $18,900 and sell for $880,000.

RCA 6 — A medium scale real-memory computer with memory ranging from 262K bytes to 2.1M bytes. An RCA 6 with a 524,288 byte memory will rent at $29,300 and sell for $1,380,000.

RCA 7 — A medium-to-large scale virtual-memory machine with a main memory of from 262K bytes to 2.1M bytes. A typical system with 524,288 bytes of main memory will rent at $36,300 and sell for $1,680,000.

RCA 8660 Front End Communications Processor — The FECP provides full communications support for the RCA family and can interface with remote devices which use IBM's binary synchronous communications procedures. The standard configuration, available with a 32 or 66K byte memory, includes data exchange control, time control, and console typewriter.

COMMUNICATIONS ASPECT

I was most interested in the announcement of the Model 8660 Front End Communications Processor (FECP). Unlike IBM, RCA seems to have made a more definitive commitment to the communications area. Obviously, both the System 370 and the new RCA computer systems have been specifically designed for the "remote computing, integrated system, large data base needs of the 1970's." The details of the 8660 front end systems are still sketchy however, and it appears that this model more closely satisfies the definition of a programmable front end. This approach is one that we at Interdata have successfully used to provide the required flexibility needed to meet the advances in remote processing and data communications.

However, this is only a start. Obviously as the requirement for data communications continues to grow, more advanced facilities will be required. Coupled with this is the need for improved front end telecommunication software, and the support of "non-standard terminals." The approach typically taken by IBM (and perhaps emulated by RCA) is oriented towards the use of large software modules which reside in the expensive main frame core memory. The independent approach, such as our own, which might be categorized as a "plug-for-plug compatible" system, has been to reduce significantly the telecommunication overhead in the main frame by transferring this workload to the lower cost front end system. With the increased standardization of main frames and telecommunication networks the users will undoubtedly be more responsive to the lower cost approach.

While my principal comments have been directed toward one peripheral model of the over-all RCA system, I think that the communications area represents one of the more significant areas of the future.

Daniel Sinnott,
Chairman of the Board and President,
Interdata, Inc.,
Oceanport, N.J.

A MARKETING STRATEGY

RCA's announcement of their new series of computers follows the lead set by IBM in that the most important characteristics for these computers are marketing strategies rather than technological developments.

The series is directed at the largest dollar segment of the computer market, namely the IBM System/360 Models 30 and 40.

By anticipating IBM strategy for replacement of these computers with the 370 Model 135 and 145, RCA hopes to attract some 360 users in the process of upgrading; a small increase in the customers' share would be significant for RCA.

RCA has taken a calculated risk, in trying to outfox IBM. This could be a lethal mistake, especially since it may have set patterns for the other computer manufacturer announcements only to have IBM change prices or specifications.

To encourage IBM users to switch, RCA is offering: • A low-cost service guaranteeing conversions from 360 to RCA; • A virtual memory capability; • A communications front-end; • An emulation capability; • Some new peripherals.

RCA will most likely gain a share of the market from the IBM 360 Model 30 and 40 class, but will not be able to compete for the Model 50 conversion against the IBM 370/155. In the process, RCA must erode its own revenue base in the Spectra 70 series, and will find it difficult to keep the new software requirements maintained and updated.

Quantum Views, an information service of Quantum Sciences Corp., New York, N.Y.

MEETS THE USER'S NEED

For the first time, IBM's third generation customers have a viable option to convert to an IBM competitor's computer with a predetermined and guaranteed conversion cost! RCA now makes this offer to IBM 360/30, 40, and 50 users – representing over 50% of IBM's System/360 users. They expect to extend the offer to other 360 users at a later date.

This courageous attack at the very heart of IBM's business, opens a whole new path for these IBM users – bothered and bewildered by unbundling. Since RCA has also a bundling option, the user has a good opportunity to identify and project his total costs more precisely. RCA has provided a pathway to remove the fear the average user has about the possibility of leaving "big brother."

The result gives RCA the potential to capture 25% of IBM's market by 1975. RCA's chief executive, Robert Sarnoff, has made the corporate commitment. The head of the computer effort, Ed Donegan, has the knowhow. It remains to be seen if they can train enough qualified salesmen and support staff to compete head-on with IBM and win a significant percentage of the time.

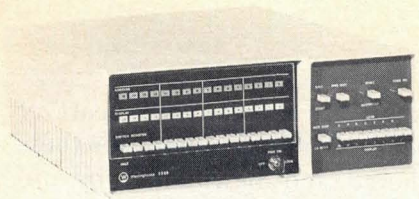
The customers they do win are likely to be satisfied, since the guaranteed conversion contract carries a daily penalty clause for overruns. RCA is learning the IBM view that customers will buy convenience – in conversion, services, and finances – and not just promises of better systems and faster technology.

Robert Sarnoff said, "The progress of the computer business in the 1970's will be determined more by specific needs of the users than by further radical changes in technology." This view was corroborated by many leading computer users in 15 industry, government, and professional areas at the recent ACM '70 conference in New York City. This was the first computer conference, and hopefully not the last, held specifically for users to describe their needs to the computer industry.

By taking a thorough systems approach to the computer business, and by making a sound, long term dollar commitment, RCA predicts they will have a billion dollar computer business by the late 1970's and be number two in the industry. They'll have to overtake Honeywell Information Systems, Inc. (the result of the merger with G.E.) and others. RCA has clearly recognized that the only way to reach that goal is to attack IBM right where it hurts – by taking their customers away. It can be done, but it takes plenty – courage, money, knowhow, hard work, thousands of hungry salesmen, and training.

Paul D. Oyer, President, Oyer Professional Computer Services, New York, N.Y.

NEW PRODUCTS



SMALL-SCALE COMPUTER

The Westinghouse 2500 is a 16-bit, 850 nanosec. computer with a basic internal memory of 4096 words, expandable to 65K. Modular design permits both hardware and software expansion in the field. The 2500 will be supported by a full line of peripherals — teleprinters, paper tape systems, card reader, line printer, disk drives, mag tape transports. The basic 4K 2500 will sell for $9950. *Westinghouse, Orlando, Fla.*

Circle No. 331 on Inquiry Card.

360 VIDEO DISPLAY

The TC-70, an operator-oriented video display terminal that is IBM 360 compatible, has been introduced by Terminal Communications. The communication section of the TC-70 operates with a six-level BCD code identical to that employed by the IBM 2740 terminal. The TC-70 physical characteristics feature a keyboard with the comfort and quality of an electric typewriter, a 12-inch non-glare screen, and ¼-inch alphanumeric characters. The TC-70 is supplied with either 512 or 1,024 character versions, and with RS232-B interface or with internal modems compatible with Western Electric 103 or 202 Data Sets. *Terminal Communications, Raleigh, N. C.*

Circle No. 322 on Inquiry Card.

CORE MEMORY SYSTEM

The ComRac 1100 is a mainframe core memory system with a cycle time of 900 nanosec and an access time of 350 nanosec. The 1100 comes with 8K x 18 capacity and can be expanded to 16K x 18 by plugging an additional module into the chassis. Price is less than $10,000 for the 8K x 18 with tester and power supply. *Information Control Corp., Los Angeles, Cal.*

Circle No. 334 on Inquiry Card.

LSI MINICOMPUTERS

Data General has introduced a line of 16-bit minicomputers which incorporate LSI and semiconductor memory in their circuitry. The Nova 1200 is a 1.2 microsec machine with its cpu, 4K core memory, and I/O systems built on a single 15 sq. inch circuit board. The Nova 800 is a fully-paralleled mini with an 800 nanosec cycle time. The Supernova SC is an all semiconductor, 300 nanosec machine capable of executing arithmetic and logical instructions in a single memory cycle. *Data General, Southboro, Mass.*

Circle No. 333 on Inquiry Card.

CASSETTE DATA RECORDER

The Model A30 Telecassette recorder is a desk-top unit that automatically acknowledges calls from remote locations and controls, monitors, and corrects for data transmission errors. It records on tape cassettes (EIA Type CP-2 or equal) digital data sent over voice-grade telephone lines using standard data sets. The A30 features an automatic cassette changer that positions up to 10 fresh cassettes for recording and rejects them to an output hopper after recording is completed. If an error is detected during recording, a control signal causes the transmission to stop, after which a partial rewind and retransmission takes place at the originating point. The A30 sells for $3650, or rents for $126 per month, including service. *Data Instruments Co., Sepulveda, Cal.*

Circle No. 325 on Inquiry Card.

COMMUNICATIONS PROCESSOR

The DCC-90 can be used as a "front-end" processor or remote programmable concentrator, and can be applied to concentrate and handle traffic from user terminals which require access to a central processor either locally or remotely. The system features synchronous and asynchronous communications with ranges of 2,000 to 50,000 baud and 40 to 9600 baud respectively. Hardware and software modules are offered which configure the system as a front-end to medium- and large-scale computers. Direct interfaces are provided for disk memory systems, line printers, card reader/punches, and other peripheral devices. Software elements provided include operating system, on-line diagnostic system, and utility programs for custom-installation programming. An average system with 75 lines is priced at $80,000. *Time-Zero Corp., Hawthorne, Cal.*

Circle No. 343 on Inquiry Card.

CERTIFIED DIGITAL CASSETTE

The cassettes, designed to fit into any standard (Philips-type) deck, use tape .150 inches wide and are available in lengths of 150 and 300 feet. Each cassette shipped passes rigid certification procedures which check the following items: slitting accuracy, rippled edges, output uniformity, dropouts, noise level, tolerance of plastic parts, and fast wind characteristics. *K/Tronic, Inc., Cupertino, Cal.*

Circle No. 317 on Inquiry Card.

VIDEO IMAGE PRINTER

The MTD-251 video printer provides high-resolution photographs from a miniature CRT without the need of an optical lens system. The printer can be used as a computer output and utilizes a fibre-optic CRT to form the image on silver halide paper or film. *Matsushita Electric Corp., N.Y., N.Y.*

Circle No. 335 on Inquiry Card.

OPTICAL MARK READER

The Dataterm-3 can read manual or machine coded bar marks on documents of from 6 x 8 to 12 x 18 inches. Documents may be hand or auto fed through the 20-column reading station at speeds of 1 to 20 inches/sec. *Digital Resources Corp., Houston, Texas.*

Circle No. 342 on Inquiry Card.

75 IPS TRANSPORTS

The PEC 6000 Series 75 ips transports use mechanical buffer arms and 10-½ inch reels, and are specifically designed for use in minicomputer systems. The design of the mechanical buffer arms and the elimination of vacuum system components ensures that there are no velocity transients and no overshoot. The simplified design also means program-restriction free operation at 75 ips. The synchronous transports offer high data reliability in 7- and 9-track NRZI USASII and IBM compatible formats. The PEC 6600 Series offers the same high performance for the 9-track 1600 cpi phase-encoded USASII and IBM compatible formats. They are available in read-after-write and in write/read versions. The transports also offer other features such as program-restriction free operation, single capstan drive, tape cleaner, easy tape loading, and IBM compatible guides. The line of 75 ips models are plug-for-plug compatible with PEC's other configurations in the popular 6000 Series transports. *Peripheral Equipment Corp., Chatsworth, Cal.*

Circle No. 324 on Inquiry Card.

NEW SOFTWARE AND SERVICES

PORTFOLIO MIS

XPORT II is a time-sharing, on-line portfolio management information service which utilizes the IBM/360. XPORT II facilitates the management of a large number of portfolios by allowing the user to: buy, sell, add, and delete all classes of securities; adjust holdings for stock dividends and splits across all portfolios; determine cash balances at any time; store security holdings by tax lot; maintain a history of all transactions; and with one command, issue an appraisal by automatically accessing current prices of securities. XPORT employs the Interactive Financial Data Base, assimilated from the New York Stock Exchange, American Stock Exchange, and 1,800 Over-The-Counter stock, and real-time prices from an on-line ticker. The combination of production service and on-line services will cost between $65 and $100 per year, per portfolio. *Interactive Data, Waltham, Mass.*

Circle No. 386 on Inquiry Card.

PDP-10 ALGOL

The PDP-10 Algol package is made up of a sharable compiler, a sharable operating system, and a library of scientific subroutines that give the user a powerful version of an extended Algol 60 capability. The compiler includes features of the Algol 60 revised report, as well as string handling facilities, byte manipulation, double precision floating point facilities, assignments within expressions, facilities for separate compilation of procedures, octal constants, and a modulus operator. The compiler takes between 10K and 12K words of core, and compiles 4000 lpm in one pass. *Digital Equipment, Maynard, Mass.*

Circle No. 390 on Inquiry Card.

COM SOFTWARE

DatagraphiX Automated Retrieval Techniques (DART), is designed for converting computer-generated data into microform structure for use in information systems. The programs control and reference the location of all data elements introduced into the data base. DART is written in COBOL language and consists of an assemblage of software subsystems which can process print image data in most "standard" codes. Control cards offer the user a selection of output options including roll film format, microfiche with or without titling, single or multi-level indexing, and job control data. *Stromberg DatagraphiX, Inc., San Diego, Cal.*

Circle No. 378 on Inquiry Card.

MARKETING DATA SERVICE

XTAB provides marketing research managers with a time-sharing, on-line retrieval and cross-tabulation program for survey data. To implement XTAB, users submit their survey data (usually in the form of multiple choice responses), which are processed and loaded on the system. The user can then, with a simple, conversational program access the results of his survey by requesting either a simple tabulation, cross-tabulation, or a histogram, which are displayed instantaneously. The user also will be able to retrieve a whole library of previous and current surveys which he can maintain on-line and immediately available for as long as desired. The major advantages of XTAB are that it is less costly to use than accessing survey results in a batch environment, or employing a service bureau; it also enables the user to receive immediate answers while performing his research. *Interactive Data, Waltham, Mass.*

Circle No. 377 on Inquiry Card.

NEW SOFTWARE AND SERVICES

COURSE IN LINEAR PROGRAMMING

A programmed instruction course in linear programming, covering concepts, models, and computer applications, is available for $47.50. *Entelek, Newburyport, Mass.*

Circle No. 388 on Inquiry Card.

OCR SOFTWARE

SWAMI — Software Aided Multi-font Input — is a self-teaching software which will increase the reading capability of Scan-Data systems. SWAMI utilizes the feature extraction recognition technique to sample the position of stroke characteristics and compare them with reference characters. *Scan-Data, Norristown, Pa.*

Circle No. 389 on Inquiry Card.

MINICOMPUTER BUSINESS FORTRAN

Computing Corporation International has announced MCBP, a complete minicomputer business software package for small business applications. The package is written in Fortran IV and consists of 30 programs that perform the functions of: Accounts Receivable, Accounts Payable, Payroll, Labor Distribution, Inventory Control, General Ledger, Profit/Loss, Balance Sheets, Information Retrieval Storage, and File Setup and Maintenance. MCBP is designed for one-time data entry with automatic carry-through and automatic journal postings. All data input utilizes free-field which reduces the cost of data preparation. The package is designed for complete random accessing of data within disk files for systems having DOS, thereby eliminating expensive sort/merge operations. Program operation may be initiated conversationally from the control console or from card input. Data may be batched on disk or tape from any input device handled by the operating system. *Computing Corporation, Englewood, Colo.*

Circle No. 384 on Inquiry Card.

SCIENCE DATABANK

The CODAB/ORCHEM databank is based on the physical constants of organic compounds found in the *Handbook of Chemistry & Physics*. The databank is organized by compound sequentially on EBCDIC or ASCII, 9-track, 800 bpi tape. *Science Databank, Cleveland, Ohio.*

Circle No. 387 on Inquiry Card.

TAPE CERTIFICATION

NSPEC, a magnetic tape certification program, utilizes special channel programming to ascertain present quality of any number of tapes on a single program run on IBM/360 under OS or DOS. A printed output gives location and number of errors, as well as total of usable feet of tape. *Cybernetics & Systems, Louisville, Ky.*

Circle No. 385 on Inquiry Card.

NEW LITERATURE

PUNCHED CARD EQUIPMENT

A series of specification sheets describing a line of card readers, sorters, keypunches, and verifiers is available. *Decision Data, Warminster, Pa.*

Circle No. 400 on Inquiry Card.

IBM-COMPATIBLE DISK SYSTEM

A specifications sheet on the CDC 23121 disk system, a 2314-compatible drive, is available. *Control Data, Minneapolis, Minn.*

Circle No. 405 on Inquiry Card.

DATA ENTRY SYSTEM

A technical summary on the Entrex 480 key-to-tape system describing design, operation, and system hardware is available. *Entrex, Lexington, Mass.*

Circle No. 419 on Inquiry Card.

MACHINE CONTROLS

The Xenex modular machine tool controller is described in a 10-page brochure. The controller uses a HON H112 to control machine tools directly without the intervention of standard numerical control. *Xenex Corp., Waltham, Mass.*

Circle No. 404 on Inquiry Card.

CRT DISPLAY CHARACTERISTICS

An eight-page resume lists hardware characteristics of 119 commercially-available CRT console displays separated into two categories: alphanumeric inquiry types and vector-drawing multipurpose types. The brochure also includes all available pricing information. *Keydata Corp., Watertown, Mass.*

Circle No. 403 on Inquiry Card.

JOB-SCHEDULING

A manual on TSR's production job-scheduling system, which outlines design concepts, data files utilized, and reports generated, is available. *Time Sharing Resources, N.Y., N.Y.*

Circle No. 411 on Inquiry Card.

APPLICATIONS MANAGEMENT SYSTEM

An explanation of COSMOS — an Applications Management System — is available in a 12-page brochure. The system was developed to provide computer users with an effective means of streamlining the design, implementation, and production of customized applications. *PHI Computer Services, Arlington, Mass.*

Circle No. 406 on Inquiry Card.

COMMUNICATIONS EQUIPMENT

A brochure describing Pulsecom's line of data communications, telephone, communications switching, and communications control equipment is available. *Pulse Communications, Falls Church, Va.*

Circle No. 401 on Inquiry Card.

IBM-COMPATIBLE CORE

An IBM 360/50, 65, 67, or 75 plug-to-plug peripheral, the System/6000 Large Core Store, is described in a 6-page brochure. *Data Products, Woodland Hills, Cal.*

Circle No. 408 on Inquiry Card.

VIDEO DISPLAY SYSTEM

A six-page brochure describing the total systems approach to computer communications on System/360 utilizing standard off-the-shelf hardware and software is available. *Computer Commmunications, Inglewood, Cal.*

Circle No. 410 on Inquiry Card.

DOS/360 PACKAGE

A program testing and production job control package for DOS/360 users — Control/360 — is reviewed in a 6-page booklet. *HW Systems, Los Angeles, Cal.*

Circle No. 409 on Inquiry Card.

MINICOMPUTER MANUAL

A 656-page Systems and Operation Manual for the Raytheon 704 minicomputer, written for the requirements of automation and system designers, has been published. The Manual features detailed information on organization, addressing, instruction repertoire and classes, input/output system software, and detailed specifications. Features of the processor and use of the more than 600 programs and subroutines available are fully described. *Raytheon Computer, Santa Ana, Cal.*

Circle No. 412 on Inquiry Card.

KEY-TO-CASSETTE

An 8-page brochure describes the Term-mite terminal — a $75/mo. video unit designed to replace keypunch equipment. *Data Input Devices, Derry, N.H.*

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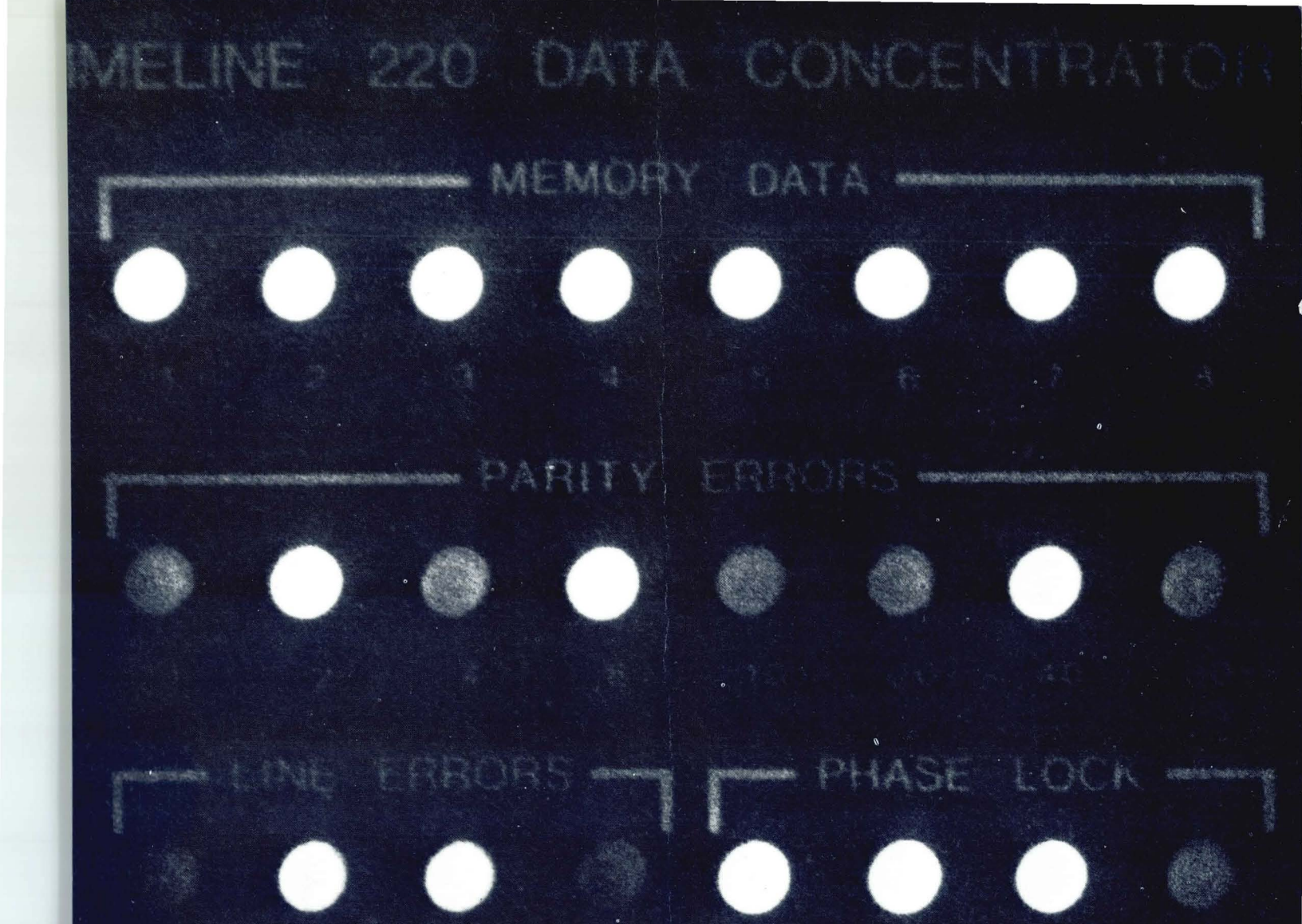

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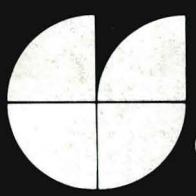

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